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ABSTRACT

The purpose of this study was to determine the design features of the physical learning environment that support and enhance collaborative, project-based learning at the community college level, and to gain an understanding of the rationale for selection of the features. The characteristics of the physical environment investigated in the study were scale, location, functionality, relationships, and patterns. Aspects of the rationale or purpose for the selected features included: (1) important factors for consideration; (2) sequence of consideration among the factors; (3) relationship among the factors; (4) derivation of the factors; (5) design process considerations; and (6) theories used to make the recommendation. Data were collected in three phases using a phenomenological approach to gain an understanding of the two foci areas of the study. Methods for collecting data included site visits, observations, text, interviews, and designs. Participants included architects, educators, and learners. The findings included the initial identification of 44 design features of the physical learning environment that support and enhance collaborative, project-based learning at the community college level and the determination of the rationale for the selection of the features. Analysis and synthesis of the features resulted in 32 design features that were placed in the following 6 categories: learning group size, functional spaces for learning activities, adjacencies, furnishings, psychological and physiological support of learners, and structural aspects. The study concluded that the essence of designing physical environments that support and encourage collaborative, project-based learning is the interrelationship among the categories and features within the categories. (Appendices contain research forms. Contains 104 references.) (EV)

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ED 466 089

Sustaining Systems of Relationships: The Essence of the Physical Learning Environment that Supports and Enhances Collaborative, Project-based Learning at the Community College Level

by

Susan J. Wolff

A DISSERTATION

submitted to

Oregon State University

in partial fulfillment of the requirements
for the degree of

Doctor of Education

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Completed September 7, 2001
Commencement June 2002

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AN ABSTRACT OF THE DISSERTATION OF

Susan J. Wolff for the degree of Doctor of Education in Education presented on September 7, 2001. Title: Sustaining Systems of Relationships: The Essence of the Physical Learning Environment that Supports and Enhances Collaborative, Project-based Learning at the Community College Level.

Abstract approved: ____
George H. Copa

The purpose of this study was to: (a) determine the design features of the physical learning environment that support and enhance collaborative, project-based learning at the community college level; and (b) to gain an understanding of the rationale for the selection of the features. The characteristics of the physical environment investigated in the study were scale, location, functionality, relationships, and patterns. Aspects of the rationale or purpose for the selected features included: (a) important factors for consideration, (b) sequence of consideration among the factors, (c) relationship among the factors, (d) derivation of the factors, (e) design process considerations, and (f) theories used to make the recommendation.

The literature review indicated a need for changing learning expectations to prepare learners for rapidly changing roles and responsibilities in work, family, and community for the 21st century. Collaborative, project-based learning was identified as a pedagogy that prepares learners for these new learning expectations by conceiving, developing, and implementing projects relevant to the learners' and the communities' needs. This active learning process teaches critical thinking, problem solving, teamwork, negotiation skills, reaching consensus, using technology, and taking responsibility for one's own learning.

Data were collected in three phases using a phenomenological approach to gain an understanding of the two foci areas of the study. Methods for collecting data included site visits, observations, text, interviews, and designs. Participants included architects, educators, and learners.

The findings from the study included the initial identification of 44 design features of the physical learning environment that support and enhance collaborative, project-based learning at the community college level and the determination of the rationale for the selection of the features. Analysis and synthesis of the features resulted in 32 design features that were placed in the following six categories: (a) learning group size, (b) functional spaces for learning activities, (c) adjacencies, (d) furnishings, (e) psychological and physiological support of the learners, and (f) structural aspects. The essence of designing physical environments that support and encourage collaborative, project-based learning is the interrelationship among the categories and features within the categories.

Doctor of Education dissertation of Susan J. Wolff presented on September 7, 2001

APPROVED:

Major Professor, representing Education

Director of School of Education

Dean of Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Susan J. Wolff, Author

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The successful completion of this study is due to the encouragement, support, and participation of many dedicated and entrepreneurial learners, educators, and architects, as well as professional colleagues, family, and friends. First and foremost, I gratefully acknowledge the insight, wisdom, inspiration, and mentoring freely given by my major professor, Dr. George Copa. He created an awareness of a new professional field and inspired a deep passion for improving learning, teaching, and being. His tireless support of my learning deserves special tribute.

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TABLE OF CONTENTS

CHAPTER PAGE

1 FOCUS AND SIGNIFICANCE OF THE STUDY 1

Focus of the Study 3

Significance of the Study 4

Summary 20

2 REVIEW OF LITERATURE 22

Key Concepts, Search Process, Organization of Materials 22

Learning Processes 27

Features of the Physical Learning Environment that Support and Enhance Collaborative, Project-based Learning 33

Summary 35

3 DESIGN OF STUDY 37

Researcher's Perspective 38

Methodology 40

Design of the Study 42

Soundness of the Data 48

Research Participants 49

Data Analysis 52

Summary 60

4 FINDINGS AND ANALYSIS OF PHASE I 62

Findings from Site Visits 62

Findings from Internship Activities 73

CHAPTER PAGE

Analysis of Phase I..........79

Steps from Phase I to Phase II..........90

5 FINDINGS AND ANALYSIS OF PHASE II..........91

Findings from National Conference Participation..........93

Findings from International Conference Participation..........98

Analysis of Phase II..........119

Steps from Phase II to Phase III..........135

6 FINDINGS AND ANALYSIS OF PHASE III..........137

Findings from Design Studio..........139

Analysis of Phase III..........166

7 UNDERSTANDINGS AND FUTURE RESEARCH..........199

BIBLIOGRAPHY..........218

APPENDICES..........226

Appendix A ... Phase II Electronic Mail Interview Questions..........227

Appendix B ... Phase II Participant Consent Form..........229

Appendix C ... Phases II and III Research Participants..........232
(Names of those participants requesting
identification be released)

Appendix D ... Phase III Participant Consent Form..........234

Appendix E ... Design Studio Agenda..........240

LIST OF FIGURES

FIGURE PAGE

1 Data gathering and analysis process....58

2 Learning community diagram....118

3 Design # 1....143

4 Design # 2....153

5 Design # 3....156

6 System of relationships of collaborative, project-based learning....214

LIST OF TABLES

TABLE PAGE

1 Three Phases of Study Design....44

2 Design Features and Related Rationale of the Physical Environment that Supports and Enhances Collaborative Project-based Learning at the Community College Level from Phase I....83

3 Design Features and Related Rationale of the Physical Environment that Supports and Enhances Collaborative Project-based Learning at the Community College Level from Phases I and II....121

4 Design Features and Related Rationale of the Physical Environment that Supports and Enhances Collaborative Project-based Learning at the Community College Level from Phases I, II, and III....167

5 Design Feature Categories that Support and Enhance Collaborative, Project-based Learning at the Community College Level....197

6 Design Features and Supporting Rationale of the Physical Learning Environment....204

DEDICATION

I dedicate this research and dissertation to my mother and late father from whom I received an insatiable quest for new knowledge and understanding. Their encouragement and support in seeking this degree and in exploring new aspects of life will forever remain in my heart.

SUSTAINING SYSTEMS OF RELATIONSHIPS: THE ESSENCE OF THE PHYSICAL LEARNING ENVIRONMENT THAT SUPPORTS AND ENHANCES COLLABORATIVE, PROJECT-BASED LEARNING AT THE COMMUNITY COLLEGE LEVEL

CHAPTER 1

FOCUS AND SIGNIFICANCE OF THE STUDY

The majority of the current community college facilities were built beginning in the 1960's at a rate of one new college being constructed each week (American Institute of Architects, 1999; O'Banion, 1997). During the heightened building phase that continued through the 1970's, the facilities were produced in box-like, minimalist structures using concrete load bearing and exterior walls, low ceilings, and few windows (Brubaker, 1998). According to Lindblad (1995), the design features described by Brubaker, limited the sense of community among learners, reduced the ability for learner to learner and learner to teacher interaction, and inhibited the ability to create a variety of learning environments that support active learning processes. Colleges that thrive and prosper in the 21st century will be those that are able to anticipate change, redefine themselves, and align their facilities to support their institution's mission and academic plan (Reeve & Smith, 1995).

Community college presidents, boards of trustees, and legislators all over the country are faced with the dilemma of having learning facilities that are reaching the end of their useful and safe life spans at the same time resources for new capital construction or renovation are limited. Examples of the need for new or improved facilities are the following:

1. Three-fourths of the 2001-2003 biennial capital budget request to the Legislature by the State Board for Community and Technical Colleges (2000) in the State of Washington was to: (a) repair aging buildings, (b) modify facilities to use today's technology and serve today's students, and (c) increase capacity to serve the baby boom echo and adults seeking retraining.

2. On the general election ballot in November, 2000, five Oregon community colleges requested approval of a total of $244 million dollars for the improvement of their facilities.

3. In 2000, the state of North Carolina passed a statewide bond for $3.1 billion dollars for new construction and renovation of facilities for community colleges and universities. For example one of its colleges, Guilford Technical Community College, received $33 million dollars of this allocation and earlier in the year had passed a local bond for an additional $25 million. Out of the $33 million, the college allocated $5 million for repairs and renovations with the remainder going for new construction at their five sites. Of the earlier $25 million, they set aside $3 million for technology.

4. The North Harris Montgomery Community College District in Houston, Texas, passed a $186 million bond in 2000 for new construction for the ensuing three years. $90 million will go to build the new Cy-Fair Community College, $15 million will be allocated to each of the other five colleges in the district, and the remainder will go the district office.

Donald (1997) states that college policy makers have paid comparatively little attention to identifying the appropriate learning context and process for achieving stated learning outcomes and even less to the design of the physical learning environment that support the learning process. There is an abundance of research studies and published articles (Lawton, 1999; Mayer, 1999) discussing the various forms of learning processes and the linking of these processes to learning outcomes relevant to the changing context of work, family, and community life; however, there is very little research or literature on college campus and facility planning that is supportive of the needed learning processes.

Focus of the Study

When describing the research efforts of everyday lived experiences, van Manen (1990) stated that there were four fundamental, existential themes that encompass all human experience. The existential themes are: (a) lived space, (b) lived body, (c) lived time, and (d) lived human relation. Lived space is the world or landscape in which human beings move and find themselves and which affects the person's physical and emotional being.

This study has two areas of focus. The first area of focus is to identify and describe the desired features of the physical environment, the lived space for learning that supports and enhances collaborative, project-based learning in community college settings. The characteristics of the physical environment investigated in the study include scale, location, functionality, relationships, and patterns. The second area of focus of the study is the thinking behind or rationale for the desired characteristics being recommended. The thinking behind or rationale includes the following aspects:

1. What factors are important to consider?
2. What is the sequence of consideration among the factors?
3. How are the factors related to one another?
4. How are the recommendations derived?
5. What is still puzzling about the process?
6. What theories are applied in making the recommendations?

Significance of the Study

The significance of the study was based on newly defined societal and educational expectations as a result of the transition from the industrial era to the knowledge era. The new expectations were: (a) the changing roles and responsibilities of work, family, and community life; (b) the learning outcomes needed to meet the changing roles and responsibilities; (c) the learning processes that supported the achievement of the learning expectations; and (d) the features of the physical environment that enhanced a selected learning process--collaborative, project-based learning.

Changing Roles and Responsibilities of Work, Family, and Community

In addressing the changing roles and responsibilities of work, family, and community life, Walsh (1999) stated that the five, broad contemporary challenges facing today's learners and faculty were: (a) globalization, which was created by the speed with which ideas, people, capital, and cultures move with the aid of technology, which erases space and borders; (b) the changing nature of work from an industrial age to a knowledge age required new and rapidly changing desired skills and competencies; (c) the changing demographics created a diverse and multi-cultural living and working environment; (d) the changing societal norms due to fast-paced, fragmented, and changed structures that challenged traditional values and truth claims; and (e) the accelerating rate of change that required the ability to learn new things, use initiative, and take charge of one's own learning.

More specifically, the National Institute for Literacy Study (NILS) written in 2000, identified common activities used in work, family, and community roles and responsibilities in today's society. The activities included the ability to: (a) gather, analyze, and use information; (b) manage resources; (c) work within the larger picture; (d) work together; (e) provide leadership; (f) guide and support others; (g) seek guidance and support from others; (h) develop and express sense of self; (i) respect others and value diversity; (j) exercise rights and responsibilities; (k) create and pursue vision and goals; (l) use technology and other tools to accomplish goals; and (m) keep pace with change.

Relating to the changing roles in the work place, Becker and Steele (1995) stated that organizations and companies around the world were focused on: (a) using scarce resources to their fullest potential, (b) demanding teamwork and cross-functional collaboration, (c) using new information technology to its fullest to achieve desired goals, (d) being proactive in meeting changing market and cultural needs due to globalization, and (e) responding to changing labor demographics. In order for employees to contribute to the above described workplace, the National

Research Council (1999) described the abilities employees were expected to demonstrate on the job. The abilities were to: (a) analyze complex situations and problems, (b) identify and implement solutions, (c) work in high-performance teams, (d) think in terms of systemic outcomes, and (e) be more involved with the customer.

Turning to the changing context of families, Coontz (1997) stated that family structures had become complex, diverse, and fluid and the changing patterns brought the need for a greater ability for effective communication, problem solving, and the ability to anticipate and handle change. Elkind (1995) described postmodern families as having many forms, other than the nuclear family. Elkind continued to explain that the boundaries between home and work, public and private, and child and adult were much more open and flexible and that children and adolescents were expected to be much more competent and sophisticated in dealing with the rapidly changing demands of life.

Referring to the need for more effective communication, Belenky, Clinchy, Goldberger, and Tarule (1986) examined various forms of discourse among families ranging from "…are children to be seen and not heard in the day-to-day life of the family" (p.156) to "…do parents or the adults of the family teach and learn from and with their children by asking and telling" (p.157)? If the essence of the conversations between the adults and children was for the purpose of exchanging ideas, feelings, plans, and included compromises, then the conversations became a model of collaboration through sharing and building blocks of information from one another's ideas to produce knowledge, according to

Belenky, et al. The same conversational skills could be applied to learning, work, and community roles.

The parent/family role, according to the NILS (2000), was to promote family members' growth and development, to meet family needs and responsibilities, and to strengthen the family system. The ability to manage the multiplicity of individual, family, career, and community roles and responsibilities and to analyze the reciprocal impact of individual and family participation in community activities were parent/family roles defined in the National Standards for Family and Consumer Science Education (Association for Career and Technical Education, 2000).

Last, as related to the changing nature of community roles and responsibilities, the attributes to be an effective citizen/community member, according to the NILS (2000), were: (a) becoming and staying informed, (b) forming and expressing opinions and ideas, (c) working together, and (d) taking action to strengthen communities. A way to work together and take action was through the creation of partnerships or action committees, be it in a neighborhood, school, or the larger community.

Community partnerships included business, labor, education providers, and community service agencies. According to The American Association of Community Colleges, Association of Community College Trustees, and the W. K. Kellogg Foundation (Bailey, 1999 & Thompson, 1995), community colleges have provided a model for working together and taking action to strengthen community partnerships. These partnerships provided for and modeled: (a) civic awareness, (b) expanded opportunities for exploring and understanding multi-cultural issues generated by global and economic diversity, and (c) the creation a system for lifelong learning. The college and community partnerships were strengthened with the inclusion of internship, service learning, and project-based learning activities that brought the relevancy of community engagement to the learners. The learning activities prepared the learners to think, problem solve, and communicate; thus, to also make contributions in their communities.

In summary, work, family, and community life roles and responsibilities were impacted by globalization, entrance to the knowledge age through the availability and use of technology, changing demographics in population, and the accelerated rate of change. These changes, in turn, created need for new learning expectations and several initiatives were established to encourage and support attention to changing learning processes that supported the expectations.

Changing Learning Expectations and Related Educational Initiatives

To support the need for changing learning expectations, the U. S. Department of Labor's Secretary's Commission on Achieving Necessary Skills (SCANS) (1991) recommended a set of skills needed by workers of the new century. Among the skills were the ability to: (a) reason; (b) think creatively; (c) make decisions; (d) solve problems; (e) work in teams; (f) work well with people of other cultures; (g) understand, monitor, correct, design, and improve systems; (h) select appropriate technology and apply it to specific tasks, and (i) direct their own personal and professional growth through lifelong learning.

In 1996, the National Skills Standards Board (NSSB) was formed to determine national industry standards from which learners and employees would show competency in skill areas. One part of the vision of the NSSB was to encourage educational institutions to implement processes to ease the recording and acceptance of completed credits and assessment from one institution to another. A second part of the vision was to encourage educational institutions and business/industry partners to establish common competencies and common assessment tools. Another federal initiative, sponsored by the U. S. Department of Labor, to address the changing needs of work, family, and community was The Workforce Investment Act of 1998. The Act recognized the need to provide necessary family and social service support systems for people while they developed their workforce skills.

At the same time, other state and federal initiatives were established for identifying learning outcomes or expectations, for establishing new methods for assessment, and increasing accountability to legislators and taxpayers. According to the League for Innovation for Community Colleges (1999), the outcomes identified for 21st Century learners included achievement of strong (a) communication skills; (b) computation skills that included the capability of reasoning, analyzing, and using numerical data; (c) community skills of citizenship, diversity and pluralism; (c) local, global, and environmental awareness; (d) critical thinking and problem solving skills; (e) information management skills; (f) interpersonal skills including teamwork, relationship management, conflict resolution, and workplace skills; and

(g) personal skills that included management of change, learning to learn, and personal responsibility.

In summary, the impact of moving from the industrial age through the technology age to the knowledge age spanned the boundaries of work, family, and community. The skills needed to effectively fulfill the roles and responsibilities in the three areas were far different than those needed for the industrial age. The last two decades of the 20th Century saw youths and adults: (a) working and living within systems of different cultures; (b) actively participating in the global economy; (c) contributing new thinking to work, family, and community by engaging in team work creating new products and solving problems; and (d) managing their own lifelong learning. To fulfill the roles and responsibilities, youths and adults sought more active, relevant opportunities to learn the skills required to actively participate and make contributions to their work, to their families, and to their communities. The new roles, responsibilities, and expectations of the learners indicate changing learning processes.

Changing Learning Processes

Dede (1993) described the changing learning processes that were needed to prepare learners for the work place and in society. The different learning processes needed to change from "the more traditional classroom-based, discipline-focused, learning-by-listening approaches" to " just-in-time, life- and work-focused, and learning-while-doing approaches" that were linked to everyday situations (p. 3). The changing learning expectations needed for transformation in work, family, and community roles and responsibilities required new, more active learning processes.

The League for Innovation in the Community College (2000, 1999, 1998), the W. K. Kellogg Foundation (2000), and the Pew Charitable Trust (2000) funded initiatives for community colleges that identified the necessary skills for learners to contribute in their work, family, and community roles and responsibilities and subsequently identified the learning processes that best address the necessary skills.

The need for more active learning processes included pedagogical strategies such as: (a) collaborative learning, (b) cooperative learning, (c) learning communities, (d) interdisciplinary seminars, (e) integrated learning, (f) project-based learning, (g) work-based learning, and (h) community-based learning (Bruffee, 1995; Cooper, Robinson, & McKinney, 1994; Fosnot, 1993; Goodsell, Maher, Tinto, Smith & McGregor, 1992; Oakey, 1995). According to Skolnikoff (1994), educational institutions needed to provide programs in which learners learned to think and became participants in the larger world.

For this study, collaborative, project-based learning was chosen as the active learning processes that addressed the learning expectations necessary to meet and direct the challenges of work, family, and community roles as described in the previous sections. As described by (Gokhale, 1995), collaborative learning is an active learning process that groups and pairs learners at various performance levels for the purpose of working together to achieve an academic goal. More specific to this study, Bruffee (1995) stated that collaborative learning was designed for the older learner and provided learning expectations not only for content, but also for critical thinking, problem solving, teamwork, negotiating, reaching consensus, social and academic development, and developing a sense of community.

The literature described project-based learning as being oriented to the "real" world and having value and meaning beyond the teacher and learner (Bruner, 1990; Dewey, 1939; Rogers, 1969). It encouraged the building of relationships, communication skills, and the use of higher order thinking skills, such as critical thinking, to define and solve problems. Project-based learning also included using and manipulating technology. Projects promoted creativity, meaningful learning, and connected new learning to past performance or learning; incorporated authentic self and outside reflection and assessment; and instilled lifelong learning patterns (Eckert, Goldman, & Wenger, 1997; Kraft, 1999; Wankat & Oreovicz, 2000).

In summary, with the changing roles and responsibilities for work, family, and community, changing learning expectations have emerged as needed to prepare learners to meet the shift in roles and responsibilities. In turn, pedagogies were needed to address the changing learning expectations with more emphasis on active, learner centered learning processes. Collaborative, project-based learning was identified as a pedagogy that prepares learners for the new learning expectations.

A majority of the available research and examples of active learning processes such as collaborative learning (Gokhale, 1995) have been done at the primary and secondary education levels. The research studies and literature on how the design of the physical environment supported and enhanced active learning processes were also significantly K-12 based. It was my opinion that community colleges could be informed by the more active learning pedagogical practices of the K-12 systems and how they have designed physical environments that support those pedagogical practices. Based on her research study, Feather (1998) stated that confidence in the use of cooperative learning in the college classroom was based on extensive research at the K-12 level (p. 6).

In recent meetings that I attended, I was struck by comments made by two individuals, one from a community college and the other from a K-12 district, relating to new learning expectations and how the physical learning environments may need to look differently to support the expectations. Michael Holland, Vice President of Administration and Student Affairs, Linn-Benton Community College in Albany, Oregon, recently stated in a meeting of educational professionals and community members that, "Due to the increased accessibility of postsecondary learning through distance learning and other educational providers, community colleges are beginning to recognize that they, too, must change their practices" to support the needed learning and attainment of identified learning expectations in preparation of learners to meet the changing roles and responsibilities of the 21st century. To support and enhance collaborative, project-based learning, how do community colleges design physical learning environments in which learners successfully gain the understanding and skills to meet the challenges of their future?

Designing Physical Learning Environments

In spite of the initiatives and recognition by some educators that there was a need for changing learning processes, several speakers at the recent Innovative Alternatives in Learning Environments International Conference (2000) expressed concern that the learning processes being used today in high schools and colleges were still based on the late 19th Century and early 20th Century practice of students being products of education factories. In a recent design session for a new high school, Donald Eisman, Superintendent of the Sumner School District, Washington, described why the thinking of and designing of school facilities remains locked in the early 20th Century. Eisman stated that "…it is our collective and idealized memories of the learning setting that could be the greatest barrier for designing facilities that will help learners achieve success today and in the future."

Reflecting on my experience as a community college administrator indicated that the design of the majority of community college learning settings were also based on the historical thinking and practice described by Eisman. Combining the concerns of dated learning processes and physical learning settings, Perelman (1992) stated that the early pattern of students being passive recipients of knowledge, while being seated in traditionally designed classrooms, had been indelibly stamped on each successive generation.

Several authors claimed that serious attention be given to designing or altering the physical learning environment to support and enhance the new forms of learning, which prepared people for their various roles in society (Iannone, 1997; Tinto, Goodsell-Love, & Russo, 1993). Prior to the 1990's, most of the existing learning facilities were designed to sustain a model of education characterized by large-group, teacher-centered instruction occurring in isolated classrooms (National Clearinghouse for Educational Facilities, 1998). By the late 1990's, more attention was being given to the design of educational facilities by both educators and architects. The American Institute of Architects (1999) sponsored a conference on renovating early and middle 20th Century schools. One session of the conference covered the three current trends in educational programming, which required a redefinition of classroom space and the need for flexibility in the design. The three trends listed were: (a) no more teacher as lecturer, (b) focus on project-based learning, and (c) cooperative work, which is fundamental to society and work.

To support the trends (AIA, 1999), it was stated at the conference that the desired design features included: (a) cluster seating arrangements, which may be moved to accommodate different sizes of groups; (b) individual study and work carrels; and (c) large group, conference-table seating, (d) a presentation station, and (e) access to current technology. The design allowed students to function as small groups or teams, to form large groups, and allowed for individual study and learning.

In 1998, the American Institute of Architects, the U.S. Department of Education, and The White House Millennium Council (U. S. Department of Education, 1998) held a symposium on designing schools for the 21st Century. Suggestions by symposium participants for building new schools were:

1. Enhance teaching and learning and accommodate the needs of all learners by designing physical environments that support hands-on, project-based, and interdisciplinary learning.

2. Serve as centers of the community through the creative configuration of the physical environment to accommodate learning for all age levels, to support learning during days, evenings, weekends, and summers.

3. Involve all stakeholders in the design process and provide adequate time and resources for the design process.

4. Provide healthy, safe, and secure physical environments.

5. Make effective use of all available resources by creating flexible spaces, which serve small and large groups and that office and maintenance areas should be designed to serve both as educational and operational functions.

6. Maximize the use of technological resources.

7. Allow for flexibility and adaptability to changing needs and remain open to possible changes in the community's aspirations for the physical environment.

In September, 2000, the National Alliance of Business, the U.S. Chamber of Commerce, and the U.S. Department of Education (U. S. Department of Education, 2000) held a Satellite Town Hall Meeting on modernizing schools. During the Town Hall Meeting, then Secretary of Education, Richard W. Riley challenged the audience to "…re-imagine our school buildings and classrooms to: (a) support the teaching and learning styles of the 21st Century, (b) serve multiple uses, and (c) become centers of communities for people of all ages." Secretary Riley stated that the building and what happened inside were inseparable.

A panel member from the Town Hall meeting advocated that the facility support learning in a creative and imaginative way and that we no longer have learning areas with desks and chairs bolted to the floor. Another panel member of the Town Hall meeting stated that we all learn better when learning is applied to real problems, which are connected to real life situations in the community. The physical learning environment needed to facilitate application, collaboration, integration, and community connections and large group space was needed for the activities. To prepare learners for the 21st century, the physical learning environment needed to reflect the current on-the-job environment. The panel member advocated that when designing physical learning environments, form must follow function and the environment itself should become a part of the curriculum.

One of the sites featured in the Town Hall meeting (and that I have toured), High Tech High School in San Diego, California, illustrated learning suites with individual space, team space, and project rooms--all of which allowed learners access to technology. The curriculum at High Tech High was contextualized so the learners dealt with problems that arose in a real community context.

Based on tours I have had of various agency, business, and industrial sites, the physical environment at High Tech High was designed similarly to what the learner will experience once employed. Each learner had an individual workstation in work suites and the learners had easy access to project space where projects were left out and where there was adequate storage. Classes were scheduled in seminar rooms to support discussion between learners and between learners and teachers and were organized around time frames that mirrored the workplace rather than the more traditional 50-minute class period. Project space was designed for individual or teamwork and had work counters with storage compartments underneath and had a table that served as a meeting space or as another work surface for projects.

Calvert Bowie, an architect who participated on the panel at the Town Hall meeting, described the specific design features needed in today's learning environments. Before designing the physical learning environment, he advised that the learning expectations and processes be identified prior to determining locations or the design of the physical environment. Bowie strongly stated that new schools could no longer be designed based on previous models and because larger spaces were needed to accommodate teams and collaborative efforts, and adequate access to learning technologies would need to be provided in all spaces. He saw the physical environment as a tool to create energy where people wanted to learn.

One example that Bowie gave was a school where the technology center was the key feature of the building and was placed in the front and center of the building with glass walls on the two sides facing the hallways. Access was gained from the two adjacent hallways. Instead of worrying that the learners would use the space as the path of less distance to the other hallway, the center was designed to encourage students to enter on both sides and to use the available resources. Bowie confirmed that the physical features of a learning area were an expression of the aspirations of the programs.

Field research conducted by Cornell and Brenner of Steelcase, Inc. (1993) showed that facilities played a key role in accomplishing work and that knowledge work required a new form of infrastructure. The infrastructure included technology, culture, process, and facilities. Knowledge work was dynamic and unpredictable and the characteristics for the physical environment that supported this work were: (a) flexible spaces to accommodate a variety of activities and different size groups, (b) individual space for concentration, (c) group space for collaboration, (d) space to integrate people and projects, and (e) space that is worker-centered. To support this knowledge work, the physical learning environment needed to be organized around forms of learning, which served to prepare students for responsible roles in the workplace, as active and responsible community members, and as lifelong learners (Iannone, 1997; National Council for Education Facilities, 1998).

Does design make a difference? According to the Committee on Architecture for Education (AIA, 1997) learning was a very personal thing and that all of us were more likely to learn and remember from peak experiences. The peak experiences were discrepant, random, surprising, active, and had a strong emotional element and created connections in people's memories. A recommendation that came from the AIA Committee on Architecture for Education conference (1997) was that a well designed physical learning environment could create and support the peak learning experiences and have a positive effect on learning. The Committee encouraged more research on how the physical learning environment impacts the learning process.

The Committee's review of the available research indicated that the desired features of the physical environment that supported and enhanced collaborative, project-based learning were providing: (a) flexible and larger group space for team work, (b) individual work stations, (c) space to accommodate a variety of project types, (d) hook-ups to technology, and (e) adequate and secure storage. The Committee on Architecture for Education (1997), recommended that the following questions be asked when designing or renovating educational facilities:

1. What use is intended for the space or environment?
2. Who will be using it?

3. What future plans do educators hope to implement?
4. What level of technology will be implemented and will there be upgrades to technology and in what time frame?
5. What are the needs and desires of teachers and faculty?

In summary, the related literature and the various national initiatives pointed toward the need for more active learning processes to prepare learners for the changing roles and responsibilities of work, family, and community. The majority of community college facilities were built at a time when the learning process was content driven and delivered through lecture. As the literature pointed out, learning processes today need to be more active in order to teach the knowledge and skills required to gain competency in new roles and responsibilities.

There was little research available on the features of the physical learning environment that supported active learning processes or on the design process for these environments. Yet, colleges across the country continue to spend millions of dollars building new facilities or renovating existing facilities. Will those facilities resemble the learning factories of the early 20th century or will the facilities be designed to be an integral component of a more active learning process and be flexible enough to accommodate the rapid changes in the contexts of work, family, and community life?

Summary

As community colleges are faced with aging facilities and growing enrollments and either designing new or renovating existing facilities, college personnel have an opportunity to design physical learning environments to support and enhance active learning processes such as collaborative, project-based learning. Research was available on identifying learning expectations and implementing new learning processes; however, there was very little research on the design of physical environments at the community college level that supported and enhanced these active learning processes.

CHAPTER 2

REVIEW OF LITERATURE

A review of literature was conducted to establish and expand the context, define the significance of the study (Tuckman, 1999), determine available research related to the topic, and guide the design of the study (Gall, Gall, & Borg (1999). Primary and secondary research reports and related literature were reviewed. The study was conducted in a naturalistic format; thus, the review and reporting of literature appears throughout the study. This chapter focuses specifically on collaborative, project-based learning and the design of the physical environment that supports and enhances that learning.

To guide the search process for available resources for expanding the context of and defining the significance of the study, five steps were followed to organize the search, review, and analysis processes. The steps were: (a) identifying key concepts related to the two areas of focus, (b) using a variety of search processes to address concepts and obtain materials related to the study, (c) organizing the materials according to concepts, (d) reading and analyzing the materials for appropriateness to the two foci of the study, and (e) identifying gaps in the research and looking for evidence that there was a need for the study.

Key Concepts, Search Process, and Organization of Materials

The initial key concepts used for searching materials related to the foci of the study were learning environments, learning spaces, and designing community college facilities. Search results from these descriptors were minimal. As the foci of the study became clearer, a new and more complex set of concepts emerged and were organized by: (a) learning context for work, family, and community life; (b) learning expectations; (c) learning processes; (d) learning environment; and (e) process for designing physical environments. The key concepts were:

Learning Context:

Work
21st century job skills
Workforce trends
Occupation forecasts
Globalization
Changing nature of work
Organizational change
Change in schools
Leadership
Work based learning
Workforce development
Technology in the workplace
Partnerships
Cultures of the workplace

Family
Changing nature of families
Parenting
Balance between work and family
Family systems
Lifelong learning
Life span

Community
Civic role
Citizenship
Community building
Diversity
Multi-cultural issues

Learning Expectations:

Education
New learning processes
Student achievement
Learning outcomes
Assessment
School administration
Educational innovations
National skills standards
Continuous quality improvement
Performance measures
Community colleges
Higher education
Teacher training
Organizational change
Educational change

Learning Processes:

Education
Psychology
Sociology
Technology
Curriculum
Instruction
Training
Interactive learning
Learning communities
Collaborative learning
Cooperative learning
Project-based learning
Problem-based learning
Performance-based learning
Constructivism
Brain research

Distance learning
Active learning
Academic achievement
Learning styles
Cognitive theory
Learner centered instruction
Small group learning

Learning Environment:

Physical environments
Classroom environments
Educational environment
Educational change
Small schools
Learning environment
School buildings
Architecture
Visual environment
Community college facilities
Educational facilities
Learning spaces
School facilities
Public spaces

Process for Designing Learning Environments:

Master planning
Designing learning environments
Designing college facilities
Strategic planning
Campus planning
Planning
School design

Search Process

The search process for primary and secondary research and related literature was conducted using bibliographic indexes such as Educational Resources Information Center (ERIC) and periodical indexes through Silver Platter and First Search, abstracts such as Dissertation Abstracts International, journals, and books. The process was enhanced and expedited through the ability to search electronic journals and databases available through the Valley Library at Oregon State University, ORBIS Library Consortium of Northwest Academic Libraries, and Clark College in Vancouver, Washington. In addition to using the electronic search capabilities, on-site library searches were conducted and assistance was sought from Reference Librarians at Clark College and at Oregon State University. In contrast to the wealth of available resources and materials focused on the learning context, the changing learning expectations, and the learning processes to meet those expectations, there was limited formal research available on the desired features of the physical learning environment that supported collaborative, project-based learning.

Process for Review and Critique of Materials

I used the following criteria (Gall, Gall, & Borg, 1999; Suzuki, [personal conversation, October 7, 1999]; Tuckman, 1999) to evaluate the primary and secondary resources that were obtained:

1. Was either the whole focus of the study or pieces of the study relevant to my study?
2. What are the credentials of the author?
3. Was the literature review of the study adequate in breadth and depth of the topic?
4. How well did the results relate to my research questions?
5. Were the participants' voices heard and if there were recurring themes, were the themes supported by the voices (for qualitative studies) and/or were the findings of the study generalizable (for quantitative studies)?
6. Did the design of the study contribute to the development of the design for my study?

7. Were the implications and conclusions appropriate, meaningful, and useful to my topic?

8. Was the study focused at the community college level?

Organization of Materials

The research materials consisted of journal articles published by professional and research associations, published proceedings from professional conferences, dissertations, related articles found in a variety of media, and books. The materials were organized into the following categories: (a) learning context related to the changing roles and responsibilities of work, family and community life; (b) learning expectations; (c) learning processes; (d) learning environment; and (e) design processes for physical learning environments. Each of these categories was further organized by sub-categories. For example, the learning processes category was organized by constructivism, active learning, brain research, cooperative learning, collaborative learning, and project-based learning. The review of research materials related to learning context, learning expectations, and initial review of learning process was presented in Chapter 1 of the study.

This chapter provides a more extensive review of literature relating to the learning processes of collaborative, project-based learning, which was the selected process for the study. Since construction of knowledge is the basis for active learning processes, such as collaborative, project-based learning, the review of literature relating to learning process begins with a focus on the broader and foundational concept of knowledge construction. Chapter 2 also describes the review of literature relating to learning environment and design process used for the physical learning environment.

Learning Processes

According to Goodsell, Maher, Tinto, Smith, and MacGregor (1992), learning is an active, constructive process. If one holds this perspective, to learn new information, ideas, or skills, learners have to be actively involved and interact with the information, ideas, or skills in a purposeful manner. Learners need to attach and integrate the new information to what they already know and through the active learning process, construct new knowledge.

Knowledge Construction

The five principles of a constructivist pedagogy (Fosnot, 1993) are: (a) posing problems of emerging relevance to learners, (b) structuring learning around "big ideas" or primary concepts, (c) seeking and valuing students' point of view, (d) adapting curriculum to address students' suppositions, and (e) assessing student learning in the context of teaching. Knowledge and truth are created, not discovered, by the mind according to Denzin and Lincoln (1998) and constructivists are deeply committed to the view that what learners take to be objective knowledge and truth are the result of their own perspective. When knowledge is constructed, new information is processed through existing cognitive structures and connected to previous knowledge, is retained in long-term memory, and through active engagement is used to reconstruct previous knowledge and create new knowledge (Johnson, Johnson, & Smith, 1991). Collaborative learning, one of the active learning processes, supports construction of knowledge.

Collaborative Learning

Collaborative learning acquaints learners with the skills needed to cooperate, negotiate, and formulate productive responses to the changing demands of the ever increasingly complex world (Bosworth & Hamilton, 1994). This type of active learning is a pedagogical process in which learners and teachers actively work together within a learning context to create, to discover and rediscover, and to use knowledge.

Pedagogy of collaborative learning. College instruction is often criticized as being focused on transmitting fixed bodies of information while ignoring the preparation of learners to engage in a continuing acquisition of knowledge, understanding, and reasoning about challenging problems (Johnson, Johnson, & Smith, 1991). The acquisition and reasoning requires that learners be active participants in their learning.

Collaborative learners are cognitively, physically, emotionally, and psychologically active in constructing their own knowledge (Lindblad, 1995) and focus on connections and integration. In her dissertation, Lindblad compared the pedagogies of competition, cooperation, and collaboration as degrees of stretching and growing collaboratively. The pedagogy of competition is static, passive, and supports a hierarchy of authority and power; whereas, the pedagogy of cooperation is active, sporadic, and supports a diverse and heterogeneous hierarchy of authority and power. The pedagogy of collaboration is dynamic, ongoing, and supports a pluralistic, heterogeneous hierarchy of authority and power. Lindblad described the pedagogies of cooperative and collaborative learning as the gradations of intellectual and social development in the learning processes of exploration, application, refocusing, and transformation.

Collaborative learning provides a rich, social context for learning through the development of a miniature social system in which the learner-to-learner and learner-to-teacher interactions create mutual support while seeking common goals and reaching consensus (Bruffe, 1984; Finkel & Monk, 1983). The multiple perspectives in learning and perception created through collaborative learning transform classrooms into knowledge communities (Lebow, 1995).

Historical basis for collaborative learning. Beginning in the 1970's and lasting for the next two decades, there were calls for changes in our society and in our educational system by citizens, lawmakers, and funding agencies. During that time frame, societal issues of fragmentation, lack of civic involvement, and feelings of alienation seemed to be mirrored in the educational system (Goodsell, Maher, Tinto, Smith, & McGregor, 1992). According to Chickering (1977) and Prakash and Waks (1985) America's global future required unprecedented levels of interdependence, sensitivity, tolerance, and social responsibility. New learning expectations and processes were needed to address the changes in society and in the education system.

Collaborative learning linked to emerging learning expectations. Through the use of collaborative learning, students integrate social and academic development, increase ability for critical thinking, and understand the interdependent relationship between learning and community interests through the use of problem-posing and solving activities (Bosworth & Hamilton, 1994). Learners using collaborative learning processes recognize their personal roles and responsibilities to themselves and the community and are able to place those roles and responsibilities in the larger social and economic contexts. Collaborative learning models what it means to question, learn, and understand in concert with others, and learners in collaborative processes recognize their dependence upon and contribution to work, family, and community decisions.

Today's learners are diverse in terms of their educational background, prior experience and skill levels, multiplicity of responsibilities, and educational and life goals. These attributes reflect the complexities of society at large. Lindblad (1995) and Slavin (1990) found that the collaborative learning process modeled living in a pluralistic democracy by teaching a group of learners who came from a mix of racial or ethnic backgrounds to focus on a common goal and to effectively work with others to reach the goal. Collaborative learning is inclusive, interdisciplinary, and multi-cultural; creates social and intellectual involvement; and builds cooperation, teamwork, and civic responsibility. Thus, collaborative learning provides the framework to support multi-cultural awareness and teaches people with different backgrounds to capture each other's strengths in order to achieve the goals set by the group or an employer or to work toward a community goal (Brown, Collins, & Duguid, 1989; Golub, 1988; Lindblad, 1995).

Project-based Learning

Project-based learning included a wide range of learning experiences (Morgan, 1983) in time frames that ranged from short-term exercises to activities that encompassed an academic term, year, or orientation for an entire higher education experience. Morgan stated that the two key benefits of project-based learning are that learners develop autonomy and responsibility for learning, and that the process is as important as the products of the learning experience. Other attributes of project-based learning are development of: (a) interdisciplinary work, (b) problem-solving abilities, (c) capacity for independent work, (d) projects relevant to the learner and based on contemporary world (Guenter, 1994; Karabell, 1998; Morgan, 1983).

Historical basis of project-based learning. Dewey (1939) strongly believed that learning was a social process and stressed the importance of giving learners direct experiential encounters with real-world problems and that people learned by doing. According to Dewey, for real-world learning to occur in the course of education, the teacher needed to provide materials and to use appropriate methods to create experiential learning that created linkages or connections to life. His principle of continuity stated that every experience brought elements from previous experiences and affected future experiences.

Bruner's (1961) research focused on discovery being a learning process from which learners acquired knowledge. The discovery process was often based in problem solving, which had its own research and pedagogical bases, but certain aspects were also used in project-based learning. Discovering the links and relationships that provided a purpose to the construction of new knowledge created a cognitive structure from which knowledge was more accessible in memory and elicited and developed an intrinsic motivation to learn.

Project-based learning today. Karabell (1998) stated that today's learners want skills and knowledge, which are directly applicable to their lives and jobs. To provide learners access to the needed skills and knowledge, students are better served by educational institutions that create interdisciplinary courses and programs matched to real-world problems that are not segregated into specific subject areas (Stern & Rahn, 1995).

According to Morgan (1983), what was meant by real-world problems was that the problems were based in contemporary social and political context. Problem solving assignments, in which learners "own" the problem and have intrinsic motivation to reach possible solutions, fosters creativity (Guenter, 1994). If you organize the learning environment so the learner is the problem-solver and the planner and manager of her/his own learning, the learner becomes motivated and takes responsibility for learning (Oakey, 1995). Oakey further states that project-based learning: (a) taps into the learners' inherent drive to learn and to do important work, (b) engages learners in complex, real-world projects from which they develop and utilize new skills and knowledge, (c) draws the learner into many disciplines to reach the solutions, and (d) develops the ability to make decisions based upon the allocation of valuable resources such as time, materials, and facilities.

Collaborative learners are also concerned with the effect that any given solution has on various stakeholders. In a society where change is constant and teamwork is a way of life, collaborative learning is essential to career development of learners (Lankard, 1996). To better prepare learners for work, family, and community roles in the knowledge age, Hancock (1997) encouraged the development of courses and programs that foster interactivity, cooperation, and collaboration.

Features of the Physical Learning Environment that Support and Enhance Collaborative, Project-based Learning

According to Kirk (2000), learners are increasingly less willing and able to learn in a lecture format and want teaching and learning to be more active and process-oriented rather than content-based. Many factors contribute to learner achievement and through what little research has been done, advocates state that educational facilities are an essential part of improving education, especially as educators move toward using active learning processes (Lawton, 1999). Relatively little attention has been paid in the literature to physical environments in relation to various active learning processes and in particular to collaborative, project-based learning.

Halpern (1994) edited a book on changing college classrooms by focusing on new teaching and learning strategies for the increasingly complex world, but there was no mention of the physical environment in which these new strategies were used. Another example of the lack of information about the physical learning environment and how it impacts the learning process was a book written by

Johnson, Johnson, and Smith (1991) about active learning in the college classroom where only one paragraph was written describing the importance of the room arrangement.

How should the physical learning environment be configured for more active learning processes? Often, the physical learning environment is a barrier to collaborative, project-based learning by limiting the sense of community and the active involvement of the learners and teachers (Lindblad, 1995). According to Brubaker (1998), the emerging trends in the design of schools in the twenty-first century are the need for: (a) flexibility of space that allows for a variety of learning methods, (b) specialized facilities that respond to specific curricula and delivery modes, (c) community space for citizens of all ages, and (d) space for a variety of on-site social services.

Current global business practices focus on high performance teams that are project, product, and goal oriented (Calcara, 1999). Many books have been written about high-performance teams in the workplace with fewer being available describing the physical context in which the teams work (Becker & Steele, 1995). The physical environment of high-performance work places could be used as a model for effective physical learning environments that support and enhance collaborative, project-based learning processes to better prepare workers, but there was no available research studies or literature linking the two physical environments.

While touring different learning settings (K-12 and community colleges) in the last two years (San Diego, CA; Littleton and Westminster, CO; Twin Cities area, MN; Corvallis, Portland, and Redmond, OR; Greensboro and Jamestown, NC; Carson City, Fallon, and Gardnerville, NV; San Antonio, TX; Issaquah, Seattle, Sumner, and Vancouver, WA; and several facilities in The Netherlands), I noted that K-12 administrators and planners seemed to be more aware of using active learning processes and designing the physical environment to engage the learners in those processes. As a community college administrator who has been actively involved in professional associations and traveled to several college campuses, the topic of physical learning environments seemed to center on "the bricks and mortar" rather than the learning activities that would occur on those spaces and how the physical environment can be an integral tool for learning.

Summary

The two foci of this study are: (a) to identify the desired features of the physical learning environment that support and enhance collaborative, project-based learning and (b) to describe the thinking behind or rationale for determining the desired features. The existing research base on the changing roles and responsibilities of work, family, and community builds a strong case for more active learning processes, such as collaborative, project-based learning, to better prepare learners for changing roles and responsibilities. Today's learners expect their learning to be relevant to their day-to-day lives and to have a voice in choosing their learning activities.

Collaborative, project-based learning was chosen as a learning process that prepares learners for the complexities of work, family, and community life. Being engaged in this learning process, learners become equipped to: (a) set academic goals, (b) work in teams, (c) define and solve problems, (d) develop critical thinking skills, (e) improve interpersonal communication, and (f) use technology to enhance learning. Collaborative, project-based learning brings relevancy and meaning to the activities by incorporating community or regional projects and involving community members in the learning process.

What was missing from the literature relating to the foci of this study was adequate research to describe the desired features of the physical environment that support collaborative, project-based learning, especially at the community college level. Relevant research that had been conducted occurred primarily at the K-12 level showing a need for similar research at the community college level.

The literature review allowed for analysis of qualitative and quantitative studies and offered the opportunity to explore different epistemologies and methodologies for conducting research. The purpose of this study was to acquire insight into how the design features of the physical learning environment support and enhance collaborative, project-based learning and to understand the thinking behind or rationale for the selection of those features. Based on gaining meaning of the two foci of the study, I selected phenomenology as the methodology for this study (Bogdan & Biklen, 1998; Denzin & Lincoln, 1998). The next chapter covers the design of the study.

CHAPTER 3

DESIGN OF STUDY

The foci of this study were to identify the design features of the physical environment that support and enhance collaborative, project-based learning and to understand the thinking or rationale behind the selection and purpose of the desired features. To acquire this knowledge and understanding, I chose architects and educators as participants and conducted the research in settings where physical environments are designed and in which collaborative, project-based learning takes place. The study was designed to seek meaning through engagement with participants using an emergent process as the study progressed. The data collected were in the form of text, photos, diagrams, and designs. Because of the nature of the foci of the study, I chose to do a qualitative study from a phenomenological perspective.

> Qualitative research is multimethod in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials such as case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts that describe routine and problematic moments and meanings in individual's lives. Qualitative researchers use a range of interconnected methods, hoping to get a better fix on the subject matter at hand (Denzin & Lincoln, 1998, p 3.)

The five characteristics of qualitative research according to Bogdan and Biklen (1998, pp. 4-7) include: (a) the research is conducted in the actual context or naturalistic setting in which the topic of study occurs on an every day basis, (b) the collected data is in the form of words or pictures rather than numbers, (c) the process of the research is as important or more so than the findings, (d) the data are analyzed inductively as it emerges, and (e) the researcher is interested in making meaning of or understanding how people make sense of their experiences and lives.

Qualitative research includes identifying the research perspective or epistemology of the researcher, the methodology used in gathering the data, and the process for conducting the analysis (Denzin & Lincoln, 1998, p.23). A phenomenological perspective of qualitative research was chosen for the methodology of this study. In a phenomenological study, the researcher builds interpersonal relationships with the participants and takes an active role in the activities seeking new information. Therefore, knowledge and understanding of the researcher's perspective is critical in determining the trustworthiness of the interpretation of the data and the new knowledge gained. Chapter 3 is organized around the following three areas: (a) insights into my perspective as a researcher, (b) methodology used for the study, and (c) the specific design of the study.

Researcher's Perspective

My research perspective is based on existentialism. Existential philosophy (Darroch & Silvers, 1982) claims that truth comes from coexisting with others and through the ensuing discourse and action. According to Charlesworth, (1975), existential philosophy focuses on the central importance of the individual human being and the "lived experience" that is the touchstone of all knowledge (p. 9). Existentialism is a means to awaken us to an awareness of our fundamental involvement in a natural-cultural-historical milieu (Langer, 1989) and is a way of understanding the phenomenology of what is happening.

For me, having an existentialist philosophy and a phenomenological view creates a strong foundation for the construction of understanding. My phenomenological view is based on feminist constructivism. Learning from this perspective (Brooks & Brooks, 1993) self-regulates and resolves the disconnect of what is known and what is new through concrete experience, collaborative discourse, and reflection.

Merleau-Ponty wrote that, "…looking for the world's essence was not looking for what it was as an idea once it had been reduced to a theme of discourse. Instead it was looking for what it was as a fact for us, before any thematisation" (Langer, 1989, p. xvi). Langer continued writing that phenomenology recognizes that our primary relationship to the world was not a thing that could be any further clarified by analysis, but that the dynamic, internal relation between the researcher and the world could only be brought to our attention rather than solved. Merleau-Ponty stated that "this bringing to attention was itself, a 'creative act,' which brought truth into being and that by getting beyond reflection, we entered the mysterious perceptual realm of gaining access to the truth" (p.xvii).

Belenky, et al. (1986) interviewed several women whose epistemology was constructivism. Belenky, et al. noted the following characteristics of the women: (a) reflective; (b) articulate; (c) notice of actions around them; (d) concern for others; (e) intensely self aware of their own thought, judgments, moods, and desires; (f) and balancing inclusion and exclusion and separation and connection (p.133). In continuing their discussion of constructivism, Belenky, et al. noted that constructivists seek to stretch the outer boundaries of their consciousness by: (a) making the unconscious conscious, (b) consulting and listening to the self, (c) voicing the unsaid, (d) listening to others, *(e) staying alert to all currents and* undercurrents of life about them, and (f) imagining themselves inside the new poem or person or idea that they wanted to come to know and understand (p. 141). Constructivist women establish a personal connection and often a relationship with what they are trying to understand. These statements describe how I view and interact with the world.

As a female administrator in two community colleges in two states for 23 years and at a major university for three years, I have "lived" the experience of establishing professional relationships to gain understanding and support of learners, faculty, staff, families, and the communities at large. All of these experiences shaped who I am and provided opportunities to stretch into new areas and construct my own meaning from them. With existentialism forming the foundation of how I view the world and feminine-based constructivism driving my strong need for understanding "lived experiences," phenomenology was chosen for the methodology of the study.

Methodology

As stated at the beginning of the chapter, I chose to conduct a qualitative study from a phenomenological perspective because of the nature of the data to be collected. According to Silvers (1986), the three central features to a phenomenological study are: (a) an ontological understanding of the researcher, their "lived" experiences, and how they viewed the world; (b) the development of the discourse between the researcher and the research participants; and (c) the ensuing, dialectical understanding that was gained through the research study. *Phenomenology aims at gaining a deeper understanding and acquisition of insights* into the nature of our everyday experiences (van Manen, 1990). He claims that from a phenomenological point of view, to research is to always question the way we experience the world and to search for new possibilities, rather than search for laws that govern behavior.

The design for phenomenological studies (Bogdan & Biklen, 1998) evolves as the study progresses and the researcher's primary goal is to add knowledge and understanding of human interaction from the participants' point of view. Langan (1984) asserted that phenomenology leads to action through description, reflection, interpretation, and appropriation. van Manen (1990) confirmed this in stating that phenomenology deepened thought and that action occurred from the thought. The criteria for truth or the epistemology of phenomenology is to make meaning of or understanding purposes, motives, intentions, truth claims, and to expose hidden meaning. Phenomenology creates a strong foundation for the construction of learning through an on-going, open-ended process, which in turn, enhances the understanding and guiding of practice (Coomer & Hultgren, 1989).

Historically, phenomenology has been concerned with community, relationship individuals have with the community, and with lived experience in the community, according to Iannone (1997) who stated that we could not define ourselves without understanding the public that surrounds us. Phenomenology helps us clarify our own thinking and understanding of our experiences in the world that surrounded us, and also gives us new knowledge to put into practice.

Coomer and Hultgren (1989) described the manner in which to establish meaning or interpretations using clarification, authentic experiences, and discovering common meanings. They further described that the validation procedure for establishing meaning is by constructing an inter-subjective, shared understanding through conversation and observation. A strong and rigorous human science (van Manen, 1990) is prepared to be “soft,” “soulful,” “subtle,” and “sensitive” in its effort to bring the range of meanings of life’s phenomena to our reflective awareness (p.18).

Phenomenology seeks to gain a deeper understanding of every day "lived" experiences, new possibilities beyond tradition, and appropriate action. Collaborative, project-based learning is designed to provide the knowledge and to teach the skills to meet the changing roles and responsibilities of learners who are seeking to contribute to work, family, and community life. Based on the review of literature, what was needed was a deeper understanding of the desired features of the physical environment that support and enhance collaborative, project-based learning and the thinking behind or rationale for the recommended features. Phenomenology was an appropriate methodology for this task.

Design of the Study

To gain the rich description, reflection, interpretation, and appropriation that Langan (1984) described for phenomenological studies, the design of the data collection and analysis processes used in this study included three phases. The phases served to: (a) move the research from an introductory and exploratory stage in which I was becoming aware of the need for the study and clarify the foci of the study, (b) reinforce the significance of the study to advocate the benefits of active learning processes in preparing learners for the rapidly changing roles and responsibilities in work, family, and community life, and (c) narrow the scope of the study to collaborative, project-based learning at the community college level. Each phase included observation, participation, reflection, and analysis of what was seen and heard. Each phase had a series of events and sub-events. Table 1 summarizes the three phases of the research.

Design of Phase I

Phase I served as an introduction to, exploration of, and clarification of the two foci of the study. This first phase was made up of two main events. The first event of Phase I was comprised of site visits to two schools in the Twin Cities area of Minnesota, which were the School for Environmental Studies and the Interdistrict Downtown School. The second event was an internship required by the Community College Leadership doctoral program at Oregon State University and included: (a) working with an architecture firm in developing a master plan for a community college and planning the pre-design for a new community college facility to be located on a university campus, and (b) concurrently working with another architecture firm in renovating an existing community college building.

Table 1

Three Phases of Study Design

	Phase I	Phase II	Phase III
Purpose	Gained awareness of and explored general topic areas of study. Began to move focus to community college level. Clarified focus of study.	Gathered data specific to collaborative, project-based learning and the design of the physical learning environment.	Gained a deeper understanding of the design features of the physical environment that support and enhance collaborative, project-based learning and the rationale for the selection of the desired features.
Events	Visited educational sites. Completed internship with an architecture firm focusing on community college facilities.	Attended a conference workshop on project-based learning. Attended a conference on innovative learning environments.	Conducted a two-day design studio in which architects and educators designed physical environments that supported and enhanced collaborative, project-based learning at the community college level.
Nature of Data	Studied physical learning environments in general and design processes for physical learning environments.	Explored the desired features that support and enhance collaborative, project-based learning.	Researched in-depth the features that support and enhance collaborative, project-based learning and the thinking behind the selection of the features.
Data Collection	Took notes from observations, participation in, and reflection of design processes.	Participated in two workshops, took notes, toured educational facilities, and conducted informal and formal interviews.	Conducted interviews, took notes from observations, reflections, participant's journals, audio- and videotapes, and participant's design work.
Data Analysis	⟷	Theme analysis	⟷

Being a phenomenological study, Phase I occurred in actual educational settings to gain a preliminary understanding of design features of physical learning environments and thinking behind or rationale for selection of features. Sources of data for Phase I included observations and notes from site visits; research and writing I did for the internship and used in the master planning process, the pre-design, and renovation projects; participation in facilities design processes; and reflection.

Design of Phase II

The second phase of the research began to narrow the scope of the study to collaborative, project-based learning and the design of the physical learning environment that supports and enhances collaborative, project-based learning at the community college level. Some of the educational sites visited in Phase II were PreK-12 level because that is the level of education where collaborative, project-based learning is most often used and sites can be found. Phase II also had two main events. The first event was participation in a project-based learning workshop session at the National Council for Occupational Education Annual Conference held in October 2000 and conducting follow-up, informal interviews with two of the presenters of the session who are community college employees.

The second main event of Phase II was the opportunity to attend the international conference, Innovative Alternatives in Learning Environments, sponsored by the American Institute of Architects' Committee for Education, Hogeschool van Amsterdam, and the National Clearinghouse for Educational Facilities. The conference was held in Amsterdam, The Netherlands, November 6 to 11, 2000, and included the following sub-events: (a) attending a pre-conference workshop, (b) touring educational facilities, (c) hearing presentations and case studies, and (d) participating in a learning space design workshop.

In keeping with a phenomenological study, the conference provided the opportunity to create relationships with several of the participants on a person to person basis at the conference and in open-ended electronic mail interviews after the conference concluded (Appendix A). The consent form for the participants involved in the electronic mail interviews is shown in Appendix B. Sources of data for Phase II of the research included observations from sites visits, notes that I took at the conference sessions, reflection, and audio-taped and electronic mail interview transcriptions.

Design of Phase III

The third and most intense phase of the research was a two-day design studio that I conducted March 26 and 27, 2001, in Portland, Oregon. The term "design studio" came from combining the definitions of "design" and "studio" (Merriam-Webster, 1993) The term "design" means to create, to fashion, to sketch; to draw, lay out, or prepare a design; to execute or to construct according to a plan. The definition of a "studio" is a working place that supports the creation of things, typically art, photography, architecture, or radio and television programming or creative acts, such as, dancing, acting, or singing. Senge, et al. (2000) described an architectural design studio as an educational tool to incorporate multiple modes of learning such as drawing, reading, writing, model-making, conversation, team and individual projects (p. 180).

The design studio provided a venue to gain a deeper understanding of the design process, not only for myself, but also for the participants, and to produce designs of physical learning environments that supported and enhanced collaborative, project-based learning. The activities of the design studio included creative and active engagement in determining the features of the physical environment and in understanding the thinking behind the selection of the design features for physical environments that supported and enhanced collaborative, project-based learning at the community college level.

Two research studies that I reviewed provided insight into methods for collecting data for Phase III. In her research study on collaborative learning in higher education, Feather (1998) described the use of observations, videotapes, flip chart pages, and group and individual interviews as means to collect data. Lebow (1995) also used multiple sources of collecting data, including the use of participant journals for his research study on constructivist values for instructional design in graduate level learning environments. Participating in the Space Workshop at the Innovative Alternatives in Learning Environments Conference in Amsterdam also developed confidence in the methods used for collecting data in third phase.

For Phase III of the study, data was gathered from the following sources: (a) my notes from observing the participants; (b) individual audio-taped interviews with the participants; (c) audio-taped recordings of selected group discussions; (d) journals that each participant kept to write her/his thoughts, insights, and questions; (e) tangible products produced by the teams in the form of diagrams, conceptual designs, and charting on large sheets of paper; and (f) a video-tape of the final presentations of the designs.

Soundness of the Data

The term, "soundness," is often used in phenomenological studies to be comparable to the term, "validity," used in quantitative studies and qualitative studies based on more conservative epistemologies. In a phenomenological research study (Denzin & Lincoln, 1998; van Manen, 1990) the researcher enters into close relationships with the research participants in order to gain an understanding of their everyday "lived" experiences. To ensure that the gathering of and the interpretation of the information were not adversely affected by the relationships, it was necessary to establish criteria to ensure soundness of the data. Those criteria (Gall, Gall, & Borg, 1999) and W. Suzuki (personal conversation, October 7, 1999) were: (a) selecting participants who were seen as credible in their fields of endeavor, (b) seeking multiple perspectives of the topics or questions being explored, (c) using a variety of methods to collect the data, (d) engaging the participants over a long period of time or through shorter, but more intense time periods, and (e) paying attention to the "dings" or "outliers" because learning can occur from the outliers not just from the more common place findings.

The credibility of the participants in all three phases was based on their extensive and recognized expertise and experience in education at the community college level or in architectural firms that had received honors for designing educational facilities. The participants live and work in several different states in the United States and from several other countries. The participants were: (a) educators who manage, teach, and learn from collaborative, project-based learning; (b) architects who have been recognized by their peers and by educators for designing innovative educational facilities; and (c) a project director for a community-based learning institution outside of the formal educational setting. Specific descriptions of the participants in each phase of the study follows.

Research Participants

Phase I Participants. The research participants in phase one of the study were K-12, community college, and university administrators, faculty, and staff; architects; educational facilities directors; educational planners; site administrators, staff, and students; community members; and government officials. These people were involved in the projects in which I participated during my doctoral program internship and provided the various educational site tours.

Phase II Participants. Participants in phase two of the study were: (a) a community college faculty member and an administrator who presented a project-based workshop at the National Council for Occupational Education annual conference, October 26-28, 2000, and (b) the architects and educators, representing sixteen countries, who attended the Innovative Alternatives in Learning Environments Conference in Amsterdam, November 6-11, 2000.

Phase III Participants. For phase three of the study, which was the design studio, five architects and five educators were selected as participants. For a phenomenological study, the building of relationships is critical; therefore it was important to balance the number of participants in phase three with the amount of time available to build affinity without taking away process time. Additionally, the number of participants was limited to keep the group size manageable for one facilitator as well as to manage the quantity of data gathered and analyzed.

The selection criteria for the participants of Phase III was experience in the following activities: (a) collaborative or project-based learning at the community college or university level as an administrator, faculty member, and/or learner; (b) management or involvement in community- or work-based learning projects; (c) design experience for innovative educational facilities; and (d) willingness to participate in a two-day intensive workshop.

The educators, each from different curricula areas, were two community college faculty members, one community college dean, a learner from a state, four-year college that emphasizes learning communities and project-based learning, and a director of a science education program at a large metropolitan science and industry museum. The architects were chosen because of their innovative design work at both the K-12 school and community college levels in different parts of the country and around the world. The participants were assigned to two teams of five. Participants who worked together in the same organization were placed on separate teams.

Multiple Perspectives. Each of the participants brought a different perspective and set of experiences to the study. The educators' experience in teaching and learning levels ranged from kindergarten through the university level to lifelong learning. Subject matter expertise among the educators included basic education, developmental education, college/university preparatory, college/university, and technical education.

The architects in all three phases brought experience and expertise in all phases of educational facility design ranging from: (a) analyzing facilities for safety, infrastructure code requirements, life span, and functionality for specific use; (b) developing master facilities plans; and (c) designing new educational facilities and renovation of existing facilities.

For the most part, the different participants were involved in only one of the three phases, which allowed for fresh thinking, a variety of responses, and a larger pool of participants. The participants also brought multicultural, national, and international perspectives to the data.

Data Collection Methods. The methods used for collecting data for each phase of the research were described in the above section titled, Design of the Study.

Engagement with Participants. My engagement with the participants in Phase I ranged from brief observations and conversations to a 10-month long internship involving daily conversations, weekly meetings, preparations for a symposium, and development of written reports and plans. Engagement with the participants in Phase II ranged from short time frames of less than one day to an intense weeklong conference where engagement with some participants was daily and for several hours. Phase III of the study was a two-day design studio in which I was engaged with the participants either individually or as a group through written and verbal communication prior to the studio and for the full two days of the studio.

Outliers in the Data. The term "outlier" is used to describe exceptions of individuals, situations, or opinions that differs from the majority of the other participants, experiences, or interpretations of meanings. Gall, Gall, and Borg (1999, p. 305) quoted Miles and Huberman as saying rather than ignoring and explaining exceptions away, "You need to find the outliers, and then verify whether what is present in them is absent of different in other, more mainstream examples…" According to Suzuki (personal conversation, October 7, 1999) through exceptions, a whole new meaning can be gained. Particular attention was paid during the analysis process to be aware of potential outliers.

Data Analysis

All of the events of the study provided the opportunity for gathering rich, diverse, and trustworthy information. Phenomenological research is about discovering the meaning of experiences, existence, or being-in-the world (Denzin & Lincoln, 1998, p.228). According to van Manen (1990), lived experiences are a process of insightful invention and discovery of disclosure and can be captured in conceptual abstractions. van Manen (1990) further explained that the essence of a phenomenon is never simple or one-dimensional and can not be understood in a single definition; thus phenomenological research involves reflection to create essential meaning in the form of text or other means of explanation. The text or explanation of a phenomenological study is usually structured in terms of meaning or themes describing the lived experience.

Phenomenological themes are not objects or generalizations, but as van Manen (1990) stated, "…these themes are more like knots in the webs of our experiences, around which certain lived experiences are spun and thus lived through as meaningful wholes" (p. 90.) Miles and Huberman (1994) explained that good qualitative information was more likely to lead to serendipitous findings and to new integrations, which then led to the generation of new or revision of existing conceptual frameworks. van Manen (1990) further stated that phenomenological thematic analysis, then, is not a rule-bound process, but rather a free act of seeing meaning or experiencing the essence.

To understand the concept of theme for phenomenological research, van Manen (1990) listed the following descriptors for themes of lived experiences:

- Theme is the experience of focus and meaning.
- Theme captures the phenomenon one is trying to understand.
- Theme is the needfulness or desire to make sense.
- Theme is the sense we are able to make of something.
- Theme is the openness to something.
- Theme is the process of insightful invention, discover, disclosure.
- Theme also gives shape to the experience and describes the content of the experience (pp. 87-88).

Phenomenology attempts to systematically develop a certain narrative that explicates themes while remaining true to the universal quality or essence of a certain type of experience (van Manen, 1990).

This study followed the premise of phenomenological research in the following areas: (a) developing deep and meaningful relationships with the participants; (b) using various and progressive data collection methods as the study progressed; (c) adapting the design of the study as the essence of the phenomena being studied continued to evolve through each phase (Tuckman, 1999); (d) attaining a greater understanding of the phenomena as a web of experiences developed as described by van Manen (1990); and (e) confirming what Miles and Huberman (1994) stated regarding good qualitative research leading to serendipitous findings, new integrations, and possible revision of existing conceptual frameworks.

Thematic Analysis Procedures

Gall, Gall, and Borg (1999, p. 298) described the steps of interpretational analysis from a phenomenological perspective as follows: (a) create an organizational system (database) of all the data collected, (b) divide the data into meaningful segments, (c) develop categories from which to code the data, (d) code the data, (e) group the categories and codes, and (f) generate themes from the categories. Examples of coding categories described by Bogdan & Biklen (1998, p.171-176), were: (a) setting/context, (b) definition of the situation, (c) perspectives held by the participants, (d) participant's ways of thinking about people, objects, and situations, (e) process, (f) activities, (g) events, (h) strategies, (i) relationship and social structure, and (j) methods.

To manage the large quantities of data collected from multiple sources, I first organized the data by each phase of the study and then by event and sub-event. The data were then analyzed in phase and event order to determine the desired features of the physical learning environment that support and enhance collaborative, project-based learning and to understand the thinking behind or rationale for the selection of the features. The analysis of the data was displayed in table format with the code, title, and description columns relating to the first foci of the study, which was the identification of the desired features of the physical learning environment that support and enhance collaborative, project-based learning. The second foci, which was to understand the thinking behind or rationale for identified features being recommended, was explained in the purpose column of the table.

The data in this study were coded using an alpha-numeric scheme. Each desired feature of the physical learning environment that supported or enhanced collaborative, project-based learning identified by the participants was coded with an "F." To indicate the numerical sequence of when the feature was first mentioned in the study, a number was assigned. A second number, either a 1, 2, or 3 was assigned to indicate the phase in which the description and purpose were identified by the participants of that phase. Examples are: (a) F1,1 indicates the first feature identified in the study, and it was described by the participants of Phase I; (b) F10,2 indicates the tenth feature described in the study, and it was described by the participants in Phase II; and (c) F44,3 was the 44th feature identified in the study, and it was described by the participants in Phase III. Features one through 28 were first identified in Phase I, features 29-33 were first identified in Phase II, and features 34-44 were first identified in Phase III.

The analysis of the data was reported in tabular format with Table 3 reporting the analysis of data from Phase I, Table 4 reporting the analysis of data from Phases I and II, and Table 5 reporting the analysis of data from Phases I, II, and III. At the end of each phase, I began to do some preliminary clustering of the identified features into possible categories of features. At the conclusion of Phase III, I did an analysis across all the features identified in the study and of the preliminary categories to look for: (a) meanings from the data that might have been missed; (b) feature titles, descriptions, or purposes that might need further development; (c) reasoning to move features to other categories; and (d) fine tuning of the categories.

I initial thought I would analyze across the phases and as they developed to drop those features not mentioned in the subsequent phase or to combine like features. Because this was a phenomenological study where data emerged throughout the study and one in which "outliers" may provide provocative insight, I did not want to lose the richness of the collected data. An example of a feature that increased in the times cited was F10, connections, that was cited four times in Phase I, seven times in Phase II, and 27 times in Phase III. Another example was F28, adaptability that was referenced once in Phase I, once in Phase II, and 16 times in Phase III. Other features may have only been mentioned in Phase I such as F19, which was personal display space, but the feature remained in the tables to be used for the cross analysis.

A small number of possible features described throughout the study were not coded because they did not appear to be specific to collaborative, project-based learning. This decision was based on the following reasons: (a) the features were not compatible with the attributes of collaborative, project-based learning identified and described in the literature review; and (b) the participants did not identify the feature as being specific to collaborative, project-based learning. At times a possible feature did not emerge as being significant until a later phase. As part of the cross-phase analysis conducted at the end of Phase III, I went back and studied the data across all three phases. If the analysis indicated that the participants had identified the feature and I had not recognized it, I then coded the feature. As a result of this, the data was recoded to keep within the numerical sequence of when the feature was identified.

To avoid replication of coding of the same feature within the same description by the same participant, I did not repeatedly apply coding. An example of this was when Feature 29, access to food and beverage first emerged, one participant mentioned it repeatedly within the same description. The feature was coded just once. If another participant mentioned the same feature and gave a different description or purpose, I did repeat the coding. Figure 1 shows: (a) the phases, events, methods and dates of data collection; (b) the interrelationships between the phases; and (c) the analysis processes used. Secondly, the figure illustrates how observation, participation, and reflection occurred in each phase of the study and informed the design of the subsequent phase.

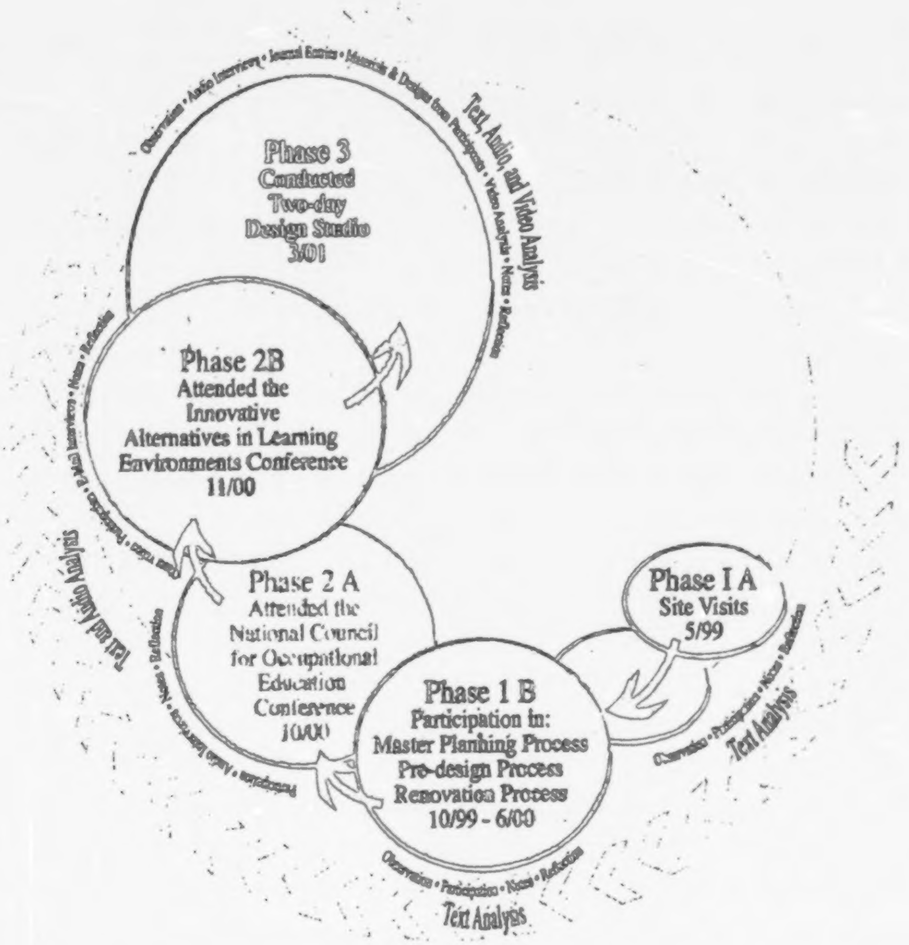
Phase 3
Conducted
Two-day
Design Studio
3/01
Observation • Audio Interviews • Journal Entries • Materials & Designs from Participants • Video Analysis • Notes • Reflection
Text, Audio, and Video Analysis
Phase 2B
Attended the
Innovative
Alternatives in Learning
Environments Conference
11/00
Participation • E-Mail Interviews • Notes • Reflection
Text and Audio Analysis
Phase 2 A
Attended the
National Council
for Occupational
Education
Conference
10/00
Participation • Audio Interviews • Notes • Reflection
Phase I A
Site Visits
5/99
Observation • Participation • Notes • Reflection
Text Analysis
Phase 1 B
Participation in:
Master Planning Process
Pre-design Process
Renovation Process
10/99 - 6/00
Observation • Participation • Notes • Reflection
Text Analysis

Figure 1. Data gathering and analysis processes.

Protection of Human Participants

The research followed the review processes developed by Oregon State University's Institutional Review Board for the protection of human participants. Consent forms were not needed for phase one of the study because it was an exploratory phase that did not involve personal interviews or data collection that was attributable to specific individuals. Separate consent forms were used for participants in Phase II and Phase III of the study. Following traditional research protocol, the identity of the participants in Phase II was kept confidential by assigning codes to the participants. However, after one participant in Phase II stated he and his firm wanted to be identified in the study, I developed a separate consent form for Phase III giving the participants the option of remaining anonymous or being identified.

Those giving permission to be identified are listed in Appendix C. Actual quotes from the participants were not directly attributable to specific participants in any case. The participants were coded by which phase of the study in which they were involved and in alphabetical order rather than alphabetically according to (e.g., P3B). The consent form used for the design studio in Phase III is shown in Appendix D.

Research Timeline of the Study

May, 1999-June, 2000	Phase I of the study
October and November, 2000	Phase II of the study
January, 2001	Portfolio presentation, oral exams, and research proposal meeting
March, 2001	Phase III of the study
April-August, 2001	Analysis of the information
May-August, 2001	Write research report

Summary

The purpose of this research study was to obtain new meaning and understanding of the following two areas of focus: (a) to identify and describe the desired features of the physical environment, that support and enhance collaborative, project-based learning in community college settings, and (b) to gain a deeper understanding of thinking behind the design features that were identified for the physical learning environments. To gain this new knowledge of the two foci, a phenomenological study was conducted.

Chapter 3 described the design of the study including the methodology and descriptions of the three phases of the research, the participants, and how the data was managed. The purpose of Phase I was to gain an awareness of and to explore the topic of how the design of physical learning environments and the features therein support and enhance active learning processes. To gain this awareness, I went on site visits to educational facilities, and to move the focus to the community college level, I designed my internship requirement of the doctoral program to work with an architecture firm and assist another firm in designing community college facilities.

Phase II of the study focused more specifically on collaborative, project-based learning processes and the features of the physical environment that support and enhance that learning. Activities of Phase II included: (a) participating in workshops and attendance at two conferences related to the two foci of the study, (b) conducting informal and formal interviews with architects and educators, and (c) continuing to go on site visits and gathering more information.

From the activities in Phase II, I gained initial insights into design features of the physical environment that support and enhance collaborative, project-based learning, however I wanted to do further research to delve deeper into the recommended design features and gain perspective as to why the features were chosen. The desire to further explore and understand the two foci of the study led to Phase III of the study, a two-day design studio, in which participants who were educators and architects designed physical learning environments that supported and enhanced collaborative, project-based learning at the community college level. The agenda for the Design Studio is shown in Appendix D. The next three chapters describe the data and findings from each phase of research.

CHAPTER 4

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FINDINGS AND ANALYSIS OF PHASE I

Phase I of the research served as an introduction to and exploration of the two foci of the study. The presentation of the findings of Phase I are organized by the two main events, which were: (a) site visits to educational facilities in the Twin Cities area of Minnesota, and (b) an internship that was a part of the Community College Leadership doctoral program at Oregon State University. The first event included site visits to the School of Environmental Studies and the Interdistrict Downtown School. The internship was comprised of three design processes for community college facilities in the Vancouver area of Washington.

The analysis of the findings of Phase I are organized by the two focus areas of the study. As described in Chapter 3, the desired features of the physical learning environment that support and enhance collaborative, project-based learning are assigned an alpha code of "F" for feature and a numeric code in the order and phase it was mentioned (e.g., for feature 1 collected in Phase I, the code given is F1,1. The same feature appearing in Phase II will be F1,2 and F1,3 if it appears in Phase III).

(DESCRIPTIONS OF THE) ~~Findings from~~ Site Visits

Phase I began while I attended the Advancing New Designs for Staffing and Staff Development conference in Minneapolis, Minnesota in May, 1999. The conference was the third activity of a project, Redesigning Education of Instructional Staff for High Schools and Community Colleges (Copa, Plihal, Birkey, & Upton, 1999) that was funded by the National Center for Research of Vocational Education (NCRVE). The purpose of the project was to develop: (a) a conceptual framework for the new roles and responsibilities of staff who lead and support educational change, (b) a list of the competencies needed by staff in the new roles, and (c) recommendations on how to address the competencies through staff development activities. Participants of the conference included K-12 and community college researchers and practitioners.

A component of the conference was visiting three sites to see and hear about innovative work being done to staff educational institutions and provide staff development in ways that support learning processes for the 21st century. The two sites that also had innovative designs of the physical environment were the School of Environmental Studies (Grades 11-12) in Apple Valley, Minnesota and the Interdistrict Downtown School (K-12) in Minneapolis, Minnesota that was due to open in the fall, 1999. The third site was Hennepin Technical College (HTC), which had used the New Designs process to organize and staff the College in innovative ways. Information regarding the HTC site visit was not included in this study because the site did not focus on innovations in physical environment.

School of Environment Studies

The School of Environmental Studies (SES) was designed and funded in partnership with the Independent School District (ISD) 196, the Minnesota Zoological Gardens, and the City of Apple Valley, Minnesota (F1,1), and is located next to the Zoological (Zoo) Gardens. "The city provided the bonding and the zoo gave the 12 acres," according to Dan Bodette, Principal of SES (conference presentation, November 10, 2000).

The SES is a focus or magnet school for ISD 196 high school juniors and seniors using environmental studies as the theme for learning. Being located next to the Zoo, learners have access to 2,700 animal species and 500 acres of wetlands and woods (Smith, 1996). During the tour, Bodette stated that the learning at SES is connected and relevant to real-life projects locally and globally and the design [of the physical environment] encourages integration of curriculum and teaching.

The learning process at the SES integrates language arts, social studies, and environmental sciences using an environmental theme in an interdisciplinary, collaborative, project-based approach. Steve Hage, a zoological education specialist on loan to the school from the Zoo, was cited by Smith (1996) as saying, "We talk about what it means to lose a wetland, about environmental economics, government law, and how it affects the Endangered Species Act and the International Boundary Waters Agreement" (p. 27). The learners attend the theme classes in the morning and the elective classes in mathematics, science, foreign language, and technology classes in the afternoon (Smith, 1996).

The learners practice becoming community leaders by accepting and solving problems as part of community-based projects. According to Smith (1996), "After getting their hands dirty like real scientists, learners used technology to synthesize and share their knowledge with the staff at the Zoo, and community and governmental leaders" (p. 26). The learners analyze data, conduct online research, create multi-media presentations, produce videos, and develop computer simulations to solve the problem they choose or to produce a product or service given back to the local community, region, state, or for some projects on a global basis.

Design Features of the Physical Environment. During the site visit to the SES, the natural setting in which the facility was placed first drew my attention. The setting includes a pond, stand of trees, and pathways that are used as learning laboratories (F2,1). There were teams of students engaged in activities in the pond when we arrived. When I entered the SES, the first feature of the interior physical environment that I noticed was a large space (F3,1) that opened up off of the entryway. I learned that the space has no singular purpose but was designed for a variety of uses (F4,1), could seat all 400 learners plus staff and was described using such terms as, a commons, cafeteria, gallery (F5,1), presentation (F6,1), and conference space. The large, common space was furnished with easily moveable, collapsible, and stackable furniture (F7,1) and included aquariums, terrariums, and a wall, in which plants grew (F2,1). The south facing wall included two-story, floor to ceiling windows (F8,1) to bring in natural light and provided a view overlooking the pond and woods.

Other walls showcased (F5,1) pictures of learners actively involved in their pursuits as well as recognition plaques for the SES honoring its curricular, staffing, and organizational models and for the design of the built environment. Behind the wall covered with plants, there was a computer/multi-media laboratory (F9,1), an art studio (F5,1), and a zoology laboratory (F2,1) The building design was two stories with the second level overlooking (F10,1) the large, common space.

The interior physical environment for the SES is designed for 400 learners who are placed into "houses" (F11,1) of 100 each. Each house has a team of three teachers who guide the theme studies to the same 100 learners all year long. The learners work with other teachers in elective classes and with community members who are involved in the theme studies courses.

The small size of the SES provides an open and flexible physical environment (F4,1) that supports a wide variety of learning experiences and the "houses" provide for personalized learning experiences through the care and guidance of the staff (Copa, Bodette, & Birkey, 1999). The four house spaces are located on the second floor and each house has: (a) a central, common area (F4,1) that can seat all 100 learners and is used for group instruction (F12,1), (b) project work space (F13,1), (c) spaces for small (F14,1) and large group (F15,1) work, and (d) "pods" (F16,1) (Smith, 1996), each designed for ten learners on three sides of the perimeter of the central, common area. The design features of the "pods" include: (a) individual workstations (F17,1) with personal, lockable storage (F18,1), (b) a display space (F19,1) for each learner to personalize her/his space, and (c) access to a computer (F9,1).

The central area of each house has adjacent (F20,1) science laboratory (F2,1), seminar (F14,1), teaching team (F21,1), and storage spaces (F22,1) for supplies and projects. At the time of my visit, there were six computers (F9,1) in each house in addition to the twenty in the multi-media laboratory located on the first floor. The SES was to be receiving additional individual computer workstations and one more multi-media laboratory in the near future.

Part of what prompted and motivated my interest in the design of the physical learning environment and its connection to quality learning came from some of the observations made and conversations held while on the site visit. The points of interest were:

1. The use of collaborative, project-based learning processes that tied the learning to local, regional, and global environmental problems.

2. The knowledge (e.g., self-knowledge, content knowledge, and community to global knowledge) and the skills (e.g., putting knowledge to practice, being skilled communicators, and actively contributing to producing products and services for others) that were explained and demonstrated by the learners.

3. The explanation by the teaching and administrative staff and the learners themselves that many of the students came to school at least an hour before the scheduled start of the day and often had to be asked to go home at the end of the day.

4. The well-maintained and clean appearance of the building, which had been open for four years and received heavy use by the learners and the community. The learners continually went in and out of the facility several times a day in all weather conditions but I saw no stains on the carpet or other signs of disrespect for the learning environment (F23,1).

5. The explanation by the learners themselves that even though they have lockable space in their desks, they leave their personal belongings out and on top of their desks because there is little theft or vandalism (F23,1).

The School of Environmental Studies was intriguing not only because of the innovative design of the physical environment, but also because collaborative, project-based learning processes were used and the learners demonstrated what seemed to be significant learning. The sense of pride and ownership shown by the learners and staff indicated that the SES was a unique place for learning.

The Interdistrict Downtown School

Another school visited by those attending the Staffing and Staff Development Conference was the Interdistrict Downtown School (IDDS), which was located in downtown Minneapolis, Minnesota. The design for the school was developed using the New Designs Process under the leadership of George H. Copa, Professor, University of Minnesota, St. Paul. The IDDS was due to open three months after our visit so I was not able to observe learners in this environment. The school principal and the managing architect led the tour of the school site.

The concept of an IDDS in Minneapolis, Minnesota (Minnesota Public Schools, 1995) was first discussed in 1989 to address the issue of voluntary racial desegregation and to design a focus or magnet school with multiculturalism as one of the themes for learning. The Minneapolis School District and nine neighboring suburban school districts, all having different racial compositions, participated in the visioning and designing processes for the school.

As stated in a 1995 report, the vision for the IDDS was first crafted in 1989 and was to create a neighborhood school in an urban setting. In spite of several years of set backs in trying to find an affordable piece of property in the downtown area, the proponents of the project kept moving forward. In 1992-93, a Downtown

Task Force was formed to address key issues and possible actions for revitalizing the downtown area.

The urban setting was chosen to provide a rich learning environment by accessing existing public and private facilities (F1,1) that included public theaters, the YMCA, and the public library. Access to the public facilities provided the opportunity to design a school facility that did not need its own gymnasium (F24,1), library (F9,1), and stage/auditorium (F6,1). Additionally, the location provided learners the experience of being in the downtown business and community environment (F1,1).

In 1995, a Design Team was formed to guide the final development of the IDDS. The Team selected five comprehensive learning goals that were being advanced by the Minnesota Department of Education as the basis for designing the learning context of the school and learning expectations of the students. The five selected learning goals included: (a) purposeful thinkers, (b) effective communicators, (c) self-directed learners, (d) productive group participants, and (e) responsible citizens.

Taking the five learning goals, the unique setting of the school, and the multicultural theme, the Team established the learning context (Minnesota Public Schools, 1995) for the IDDS that: (a) models 21st century learning and school design, (b) uses the learning richness and possibilities of the downtown, (c) makes use of related experiences and practices from the nine participating districts, and (d) promotes collaboration and integration among grade levels and disciplines. The learning context established the foundation for the development of the learning expectations and learning processes for the school (p. 11). According to Pease and Rowell in Minnesota Public Schools (1995), the Design Team then established specific learning products that would give evidence that learners had achieved the above noted learning expectations.

Skills to be developed through working on learning products (Minnesota Public Schools, 1995) included: (a) learning research skills by gathering information through the use of surveys, interviews, and focus groups, (b) defining and developing materials, (c) using appropriate technology for research and production, and (d) building trust and resolving conflict. Settings where the learning products could be researched and developed were: (a) library/resource center, (b) community areas, (c) businesses, (d) cafeteria, (e) private spaces, (f) outdoors, and (g) learning spaces within the school (pp. 26-29).

Design Features of the Physical Environment. Part of the design process for the IDDS was to envision a 21st century learning environment and link this vision with the identified learning outcomes, learning products, learning processes, and learning settings. The design of the IDDS is similar to the SES in that it provides a small-school structure through the use of "houses" (F11,1) of multi-grade level learners. The building is designed to serve a maximum of 600 students. The houses are designed for the following three learning level groupings: (a) K-5, (b) 5-9, and (c) 9-12 and would have two houses per grouping.

In addition to providing a multicultural theme or focus for the IDDS, a second theme is to incorporate the richness of the downtown area in which the school is located. In keeping with the "downtown theme," Stanton (1999) described how the street level spaces of the school were designed to include a large commons area (F3,1) similar to what might be found in a "town square or plaza." The adjacent learning areas (F20,1) are designed to be similar to a variety of shops and spaces found along a downtown street. One space is the resource/media/technology area (F9,1) designed to be similar to what might be found in a downtown bookstore or "copy" store with access to resources and technology. Two other smaller areas, with wooden floors, are used for presentations (F6,1), display of work (F5,1), projects (F13,1), and for practice spaces for dance and movement classes (F24,1). The smaller spaces have glass-paned garage doors that open to the "town square" to provide additional space (F4,1). From a picture in the Metro-State Star Tribune, September 5, 1999, learners in a movement class were visible through the glassed garage doors (F8,1) to whoever may be in the large, open plaza.

Pfluger (1995), the managing architect for the project, described the houses and laboratory/project spaces on the upper floors. Five focus laboratories (F2,1) are designed to provide specialized space and equipment for hands-on learning, movement, performances, project development, and building beyond what could happen in the house areas. The laboratories are named: (a) Nature, Wet, and Smelly; (b) Technology and Production; (c) K-5 Kids; (d) Big and Build; and (e) Sound.

With the learning processes being experiential, each of the upper floors is designed to have a common, shared space with workbench surfaces, hand tools, equipment (F13,1), storage, and supply areas (F22,1). The spaces can be closed off with glassed garage doors (F8,1) at each end. It is intended that learning "spills out" and not necessarily be contained to a specific space or time. The common, shared spaces were defined as the "glue spaces" (F10,1) that link the various learning activities occurring on that level. The floors are sealed concrete (F25,1) with the idea that project learning could be messy.

The infrastructure and mechanical systems of the building are exposed, making the building a learning tool (F26,1). Environmental quality and sustainability are elements in one of the experiential learning programs offered at the IDDS. In keeping with the concepts of designing a physical learning environment that focuses on learner needs, the windows open for fresh air and the major learning spaces are on the south side of the building incorporating natural lighting (F8,1).

A design element incorporated into the building to indicate it is a place for learning is a large, cantilevered, glassed staircase (F8,1) at the street end of the building that showcases the presence of the learners to the outside community (Pfluger, 1995). The design of the staircase serves as a visual link (F10,1) to the marquees of the theatre arts facilities on the same street.

The site visits to both the SES and IDDS provided the inspiration and motivation for my research study. To gain more knowledge and experience, reinforce the need for the study, and move the focus to the community college level, I designed the internship experience of the Community College Leadership doctoral program at Oregon State University to work with architects and college personnel who were involved in designing community college learning facilities.

Descriptions of ~~Findings from~~ Internship Activities

The internship experience for the Community College Leadership Program, as developed by the School of Education at Oregon State University, offered opportunities to gain in-depth knowledge, added skills, or to gain experience in a different area of the community college or with pertinent outside entities. My internship was with LSW Architecture, P. C., in Vancouver, Washington. The goals of the internship were to: (a) observe the working relationship between architects and community college personnel for planning and designing learning facilities, and (b) to participate in the planning and designing processes of community college learning facilities. The internship activities were also designed to move the exploration of the design features of the physical learning environment from the K-12 level to the community college level. The internship projects took place in the 1999-2000 academic year.

The internship sub-events included: (a) the development of a Master Facilities Plan for Clark College, and (b) the pre-design of the Clark Center, a Clark College facility to be built on the Washington State University Vancouver campus. Concurrently, I worked with HSA Architecture, L.L.C., Vancouver, Washington, on a renovation project to bring the Clark College Applied Arts 4 (AA4) building up to current code standards and to add a second floor to increase learning space for the College.

Developing a Master Facilities Plan

Clark College undertook the process of updating the College Master Facilities Plan in the fall of 1999. In addition to updating the existing Master Facilities Plan for the main campus, the process also addressed future opportunities and needs in the two and a half-county service district of the College. The population in Clark County, Washington was growing faster than the state's projected three percent growth rate and the population was becoming increasingly more diverse. The population growth was impacting the College's ability to meet the needs of its constituents. Updating the Master Facilities Plan was also a strategic planning mechanism for preparing timely, capital project funding requests to the State Board of Community and Technical Colleges and subsequently, to the Higher Education Coordinating Board and the Legislature in the State of Washington.

A Facilities Master Planning Symposium was held on November 30, 1999, at which key shareholders from the community, State Board for Community and Technical Colleges, Higher Education Coordinating Board, and legislators were invited to hear a keynote address by George Copa, Director, New Designs for Learning, Oregon State University. In his address, Copa provoked different ways of thinking of how the College could address the rapidly changing demands of work, family, and community and respond to a growing population that had become diverse in its characteristics and needs.

A sample of some of the points made by Copa were: (a) interdisciplinary learning prepares learners for the complexities of work and society, (b) educators needed effective partnerships with businesses, community agencies, K-12 and other higher education institutions to provide the context for learning, determine the learning outcomes, and give support in terms of staffing, locations for learning, and shared funding, (c) facilities must be designed flexibly and be able to be adapted with less effort and cost to keep pace with the changing demands of work, family, and community life, and (d) borders between educational facilities and the community need to blur and blend to provide for learning to take place at the times and places needed by learners.

After Copa's address, the audience participated in a visioning process to identify: (a) the learning needs of the community, (b) the characteristics of the various learning audiences, and (c) the facilities that would be needed to support the learning activities and the learners in reaching their intended educational goals. A campus team was formed to work with LSW Architects to develop the Master Facilities Plan (LSW, 2001).

Through the planning effort, a set of design features for the physical learning environment was developed. The design features that support collaborative, project-based learning, as described in the literature review and from what I had observed at the site visits, were: (a) multi-technology enhanced classrooms (F9,1), (b) shared facilities with other learning providers (F1,1), (c) quiet individual study (F17,1), small group and seminar spaces (F14,1), team space (F16,1), project work (F13,1), full- and part-time faculty team space (F21,1), (d) secured and adjacent storage areas (F20 & 22,1), (e) equipment intensive training areas with up-to-date technology and computers (F9,1), (f) highly flexible, self-contained, and distraction free spaces (F4,1), (g) adjacent (F20,1) work centers for staff and teachers (F21,1).

To apply the design process to specific facility projects, I participated in a pre-design process for a Clark College building that would be located on the Washington State University Vancouver campus and a design process for a building on the College campus that was to be renovated.

Pre-design of the Clark Center

The 1998 Washington State Legislature funded the pre-design for a Clark College facility to be built on the Washington State University Vancouver (WSUV) campus, located eleven miles north of the main Clark College campus (LSW, 2000). The 2001 Legislature awarded funds for the design phase for the Clark Center, which will take place in 2001 to 2003. The College will next seek funding for construction to begin July, 2003 with expected occupancy by 2005.

To provide context for the above request, the Washington State Higher Education Coordinating Board approved the establishment of branch campuses of both Washington State University (WSU) and the University of Washington (UW). Upon approval through the main university governance structures, the branch campuses were to cooperate with the local community colleges to provide the first two years of the bachelor's degree and provide the last two years of bachelor degree programs and offer a limited number of graduate degrees.

The design process for the Clark Center included faculty, administrators, and staff from Clark College and WSUV in addition to the architecture team from LSW Architects, P.C. and representatives from various state government agencies.

With the Clark Center being collocated on the WSUV site, the process addressed the master facilities plans of both institutions and the architecture firms from both institutions needed to be kept involved and informed.

When built, the Clark Center will have approximately 63,334 square feet (LSW, 2000) and house classrooms (F12,1), science laboratories (F2,1), nursing and computer-based instructional spaces (F9,1), offices, study spaces, and a community/business training center. Clark College also plans to offer at this site, selected vocational programs that will articulate into current WSUV degree programs. The two institutions will share (F1,1) plant services and infrastructure, student services, library services, food service, parking, bookstore services, student activities, security services, and child care.

Renovation of the Applied Arts 4 Building

The Applied Arts 4 (AA4) building at Clark College was built in 1958 to serve as the automotive shop area for Hudson's Bay High School of the Vancouver School District. The south side of the building was originally constructed with high bay ceilings and a single story addition had been added on the north side. Throughout the years, modifications to the building included a partial mezzanine space for added teaching and storage space and partial wall partitions as well as more permanent walls were added to accommodate changes in programs being offered in the building. It was my opinion the modifications had resulted in non-efficient use of the space and "make-do" support of the programs.

In 1999, the College was awarded funding by the Washington Legislature to update the infrastructure and meet new code requirements in the AA4 building. At the same time, the College was faced with needing more square footage of general purpose learning space to meet the needs of a growing population in its service district and subsequently, growing enrollment. During the physical assessment of the building, it was determined that due to its structural soundness and high ceilings on the south side of the building, a second floor could be added to the building to gain needed learning space.

The design process included the formation of a campus team including the faculty and staff whose programs were located in the AA4 building, the Plant Facilities Director, other campus personnel, and the architecture team from HSA Architects, L.C.C. The team addressed space and design features needed for the programs to be housed in the facility, took a tour of a career and technical education K-12 program that was noted for its innovation, and designed a facility that supported integration of the programs and the concept of shared space.

The desired features of the physical environment that emerged during the design process were: (a) providing space to meet learner, community, and industry needs (F1,1), (b) providing efficient use of the facility through flexibility in the design (F4,1), (c) providing a better learning environment through integrated learning, shared use of space (F4,1), and adequate, adjacent (F20,1) supply and storage areas (F22,1), (d) providing a model student learning center by incorporating new technology and providing for growth and change for future technology (F9,1), incorporating natural light into the interior spaces on both floors through the use of exterior windows and interior window walls (F8,1) (e) designing and placing of faculty office space (F21,1), (f) designing circulation patterns that encouraged and supported the integration of courses and programs (F10,1) and, (g) locating several small group study and informal gathering/conference spaces (F27,1) on both floors. Regarding the design and placement of faculty office space, some of the faculty were interested in being in office suites that were located close to the learning spaces while others preferred individual offices located elsewhere.

The building's original exterior wall was constructed with concrete columns placed every 20 feet along the perimeter. The construction allowed for the design of an adaptable interior with the use of de-mountable walls between the 20-foot spans. Mechanical systems were designed with this adaptability (F28,1) in mind. To achieve the required ceiling height for both levels of the building, a mechanical system penthouse was constructed on the top of the building.

Summary

The events of Phase I served as an introduction to the field of educational facilities design and how the design supported and enhanced learning processes, specifically collaborative, project-based learning. The first event of Phase I was K-12 based and with my interest and experience in community colleges, I designed the second event to explore facilities design at the community college level and gain experience in working with architects and educators involved in facility design work.

Analysis of Phase I

The purpose of Phase I of the study was to give a preliminary understanding of and gain sensitivity to the two focus areas of the study. Analysis of the data collected in Phase I was organized by the study foci and appear in Table 2. Columns one through three of the table address the first foci of the study by coding, identifying, and describing the potential design features of the physical learning environment that support and enhance collaborative, project-based learning and column four of the table addresses the second foci of the study by giving the thinking behind or the rationale for the selected features. The fifth column indicates the number of times that the feature was mentioned in each phase. Normally, in a qualitative study, enumeration or frequency counts of data elements are not included as part of the analysis (Gall, Gall, & Borg, 1999, p. 305). I listed the number of times a feature was listed, not for frequency, but to illustrate developing patterns within and between phases.

As described earlier in Chapter 3, the design features were labeled using an alpha, numeric coding scheme with "F" for feature, the first number indicating the sequential number for appearance of the feature in the study, and the second number relating to the phase in which the feature was listed (e.g., F3,1 being the third feature mentioned in the study and the identification and description were given by participants in Phase I). The same table format was used in Phases II and III as a means to organize the analysis of data. The tables also show discovery of new features and further development or decline of features.

The translation of the data from the text of the report to the summary tables involved analyzing the text in which the feature was identified to look for possible titles, descriptions of the features, and purposes of the feature in terms of how it supported and enhanced collaborative, project-based learning. Underlying this analysis was the significance of the study to prepare learners for the rapidly changing roles and responsibilities of work, family, and community life in the 21st century. Collaborative, project-based learning was determined as a process to teach those skills. For the most part, the titles and descriptions of the features were reported in the words of the participants. If my interpretation was needed, I used the context of the sentences wherein the features were identified upon which to base that interpretation. The purpose statements became more of my voice and again were based upon the participants words and thinking as given in the text. When looking for the thinking behind or rationale of each feature identified in the study, I searched for purpose statements that linked the feature to collaborative, project-based learning.

An example would be F4,2, flexible spaces that were described on page 106. Participant P2F used the term "flexibility" and Participants P2C, P2B, and P2A all gave descriptions and purposes of the feature. My interpretation of P2C's description was added using brackets to indicate my voice. The title, description, and purpose for Feature 4 is shown in Table 3, page 122. The title and description is a summary of the participants words and the description became more my own interpretation.

Because Phase I was introductory and exploratory it could be argued that some of the findings could be applied to a wide variety of learning processes beyond collaborative, project-based strategies and to all educational levels, K-12 through university. Phases II and III of the study were designed to narrow the inquiry of the design features of the physical learning environment to collaborative, project-based learning, to focus on the community college level, and gain a deeper understanding of the thinking behind or rationale of the selected features.

I analyzed the 28 design features of the physical environment identified from the event descriptions in Phase I to see if some preliminary clustering of features into categories could be done. The following four categories emerged when searching for commonalities: (a) spaces to hold different sized groups of learners, (b) spaces for different types of learning activities, (c) adjacencies among spaces for different size groups, different learning activities, and different types of support, and (d) the furnishings of the spaces.

Group Size

The design features relating to group size that were recommended in Phase I were: (a) large, open or common spaces; (b) "house"; (c) small group, team space, and seminar space; (d) large group space; and (e) teaching team space. Specifics for group size were not always given in the descriptions or presentations, but based on observations and professional experience, I chose the groups sizes to range from the individual (1), small group size (3-15), team size (5-10), and large group size (15-35). The one description that was specific in group size was the "pods" or team spaces (F16, 1) with 10 learners to a pod.

Table 2

Design Features and Related Rationale of the Physical Environment that Support and Enhance Collaborative, Project-based Learning at the Community College Level from Phase I

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	Phase I # Times Listed
F1,1	Access to community	Use of community, business, and other institutions of learning for space, curriculum, materials, personnel, and funding.	Brings relevancy to the curriculum and the learning. Builds active partnerships between agencies.	6
F2,1	Learning laboratories	Indoor or outdoor areas for learning science, technology, dance, music, and art projects.	Provides space and infrastructure to accommodate specialized equipment for learning activities, develop and practice specialized skills, bring relevancy to the learning process, and provide security of the equipment.	6
F3,1	Large, open space	Commons, cafeteria, plaza, "town square," auditorium, presentation, and gathering space.	Provides for multiple uses of the space and the ability to gather large numbers of people together.	2
F4,1	Flexible spaces	Spaces change easily and quickly for new uses or in which several activities can occur at the same time. Can be changed moment to moment and day to day to respond to changing activities (e.g., folding walls, track lighting, moveable furniture and casements, multiple technologies.	Encourages and supports integration of courses and programs through the sharing of space and equipment.	7
F5,1	Public display space	Tack boards or surfaces, display cases or wall space, galleries, and studios.	Provides places and spaces to display work, pictures, and awards to the public.	4

Table 2, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	Phase I # Times Listed
F6,1	Presentation space	Auditoriums and stages.	Space in which skills and knowledge are presented or demonstrated.	3
F7,1	Moveable, flexible furniture	Furniture that can be moved, stacked, and reconfigured easily.	Provides versatility in how space can be used to support the learners and the learning activities.	1
F8,1	Interior/ exterior windows	Outside windows, glassed garage doors, and window walls.	Provides natural light, visibility into the learning areas as well as visibility to the outside, and provides acoustical control.	6
F9,1	Technology	Telephone, facsimile machine, copier, TV/VCR, computer, printer, scanner, electrical or electronic tools, and specialized equipment.	Provides tools to locate information; produce products, services, and information; and gain skills.	9
F10,1	Connections	Links and circulation patterns among interior spaces and between interior and exterior spaces.	Space linking activities, learners, staff, and the external community as they move from one activity to another. Provides visual connection between spaces.	4
F11,1	"House" concept	A way to organize learners into "smaller" groups that stay together for a period of time up to a year.	Provides sense of small school and a learning experience focused on individual or team interests and experiences.	2
F12,1	Space for group instruction	Room that is designed and furnished to support direct instruction to a group of learners.	Provided space to teach topics, skills, or concepts to a group of learners.	2

Table 2, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	Phase I # Times Listed
F13,1	Project space	Space to provide variety of size and shape of work surfaces (e.g., tables, benches, floor space), cabinets for supplies and small hand tools, sinks, storage of projects, access to technology (in the same space or adjacent space), and task lighting.	Provides space to produce information, products, and services; practice acquired skills; and duplicate the work environment.	4
F14,1	Small group space	Space to accommodate groups of learners ranging in size from 3-15.	Used for group study sessions, team meetings, discussions with teachers/faculty, or seminars.	3
F15,1	Large group space	Space to accommodate groups of learners ranging in size from 15-35.	Used for multiple purposes for larger groups of learners who are working on projects or similar activities.	1
F16,1	Team spaces or "pods"	Space that accommodates a team of 5-10 learners and includes individual desk space, secure storage for personal belongings, team table, work space, and access to technology.	Provides personalized work areas for individuals or teams that is "owned" for a time period.	2
F17,1	Individual study, work, or reflection space	Individual learner desk, work station, or workspace.	Provides an individual work surface with a display area to personalize the space, secure storage for personal belongings, access to technology, and may or may not be located within a team space or "pod." Provides a quiet space for study, work, and a sense of one's own space.	2
F18,1	Lockable personal storage	Secure space within one's own work or study area.	Space to secure personal supplies and belongings.	1

Table 2, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	Phase I # Times Listed
F19,1	Personal display space	Tack board or display surface.	Surface to display items to personalize work or study space.	1
F20,1	Adjacent spaces	Spaces in proximity of one another.	Supports development of relationships among learners, faculty, staff, community members; and encourages integration of learning subjects and processes.	5
F21,1	Teaching team space	Office suites or teaching team rooms.	Space used for planning and preparation of curriculum and materials. In some cases designed to provide direct access of faculty to learners and learning experiences.	4
F22,1	Supply/ storage space	Space to house large sized or cumbersome supplies or a large inventory of supplies needed for projects.	Provides ready access to materials for the learning activities.	4
F23,1	Sense of pride and ownership	Space in which users feel "at home," use responsibility, and invite others to the space.	Reduces vandalism, theft, and excess wear of the space and features.	1
F24,1	Practice space	Gymnasiums and YMCA.	Space to practice skills such as physical fitness, sports, and dance.	2
F25,1	Durability	Building material and finishes that withstand heavy, messy use.	Allows spaces to be used for planned activities with less concern about damage to surfaces, such as floors.	1
F26,1	Building as a learning tool	Visible infrastructure and mechanical systems.	Provides hands-on learning in maintaining systems and relevancy to course work.	1

Table 2, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	Phase I # Times Listed
F27,1	Informal learning spaces	The non-classroom spaces where learning takes place (e.g., hallways, commons, and study spaces)	Provides small study and informal gathering/conference spaces for socializing and informal learning.	1
F28,1	Adaptability	Alteration or change in form or structure to fit new use. Larger infrastructure and space changes that take more effort and time than moment to moment or day to day changes, but are less costly and take less time than major renovations (e.g., de-mountable walls).	Ability to make space suitable for future use by means of change or modifications.	1

Learning Activities

The learning activities mentioned in the study were: (a) group instruction to teach concepts or skills to the whole team or group; (b) laboratory learning in which learners have the opportunity to discover, explore, practice, and use specialized equipment to create and produce information, products, and services for their projects; (c) project work; (d) teamwork to choose, develop, and produce a service or product; (e) individual work, study, or reflection; (e) preparation for and presentation of acquired knowledge and skills as a means of assessment; (f) practice space; and (g) informal learning.

Adjacencies

The relationship of spaces to one another showed importance in providing: (a) access to the community; (b) galleries, studios, and presentation spaces to show the learning process and final products; (c) linked spaces and circulation patterns to connect learners and learning activities; (d) exterior windows that provided a visual link between the outside and inside of the school/college as well as provided natural light and fresh air; (e) interior windows that provided a visual link between learning activities; (f) access to technology that provided information and links with other sites and people; (g) connections in terms of movement of people and products between learning areas and activities; (h) "pods" or team spaces in which small groups work together to reach a common goal; (i) informal learning spaces for learners, faculty, and staff to gather for informal conversations and activities; (j) learner access to teachers and vice versa; and (k) adjacent spaces to increase access to resources, supplies, storage, and technology.

Furnishings

The identified furnishings for the physical environment that supported and enhanced the variety of learning activities, team work, and need for flexibility in collaborative, project-based learning included: (a) moveable furniture; (b) different sizes of work surfaces such as tables or benches; (c) durability of furnishing; (d) floor space on which to do work; (e) tack boards and white boards; (f) task lighting and light tables; (g) casements to store supplies and projects, hand tools, and specialized equipment; (h) technology in the form of computer stations, copiers, fax machines, and telephones; and (i) secure, personal storage spaces.

Design Process

The design processes used for the two sites in Minnesota and three internship sites involved the formation of design teams comprising educators, community members, local and state officials, representatives from other learning providers, and in one case two students. Including the voices from these various groups proved to be fruitful in creating designs that support learning activities for a variety of constituents. The design activities of the internship were important for moving the attention of the study to the community college level and for providing a rich, personal experience of working with educators and architects in building design activities.

An observation I made from the internship activities was the need for a clearly defined academic plan in which the learning outcomes are identified, followed by the selection of the learning processes to be used to facilitate the achievement of the outcomes. Without the identification of the learning outcomes and processes, it seemed difficult to design the physical environment in a way that would support the underlying mission, vision, and values of the institution. The design process may be delayed either while the academic plan is being developed or until enough information is made available to determine the types of spaces needed to support the learning processes.

Steps from Phase I to Phase II

Phase I was introductory to the topic of how the physical learning environment can support and enhance learning processes and began to explore specifically the physical environment needs of collaborative, project-based learning at the community college level. The findings of Phase I formed a foundation of knowledge and experience for the study, but did not include sufficient opportunity to move the study from an exploratory stage of the two focus areas to one of gaining a deeper understanding.

Phase I informed Phase II of the study by showing the need to: (a) continue to narrow the focus to collaborative, project-based learning, which is the learning process selected for the study; (b) locate more community college or postsecondary education sites that use collaborative, project-based learning in order to advance the study to the community college level; and (c) identify a larger pool of participants for the study from which to gather data. To add the perspective of participant voice and use an additional method to collect data, I conducted personal interviews during and after each event of Phase II.

CHAPTER 5

FINDINGS AND ANALYSIS OF PHASE II

From the observations and experiences of Phase I of the study, I was more informed of what and how to observe and query others of the desired features that support and enhance collaborative, project-based learning. One purpose of Phase II was to narrow the scope of the study to collaborative, project-based learning and to seek more community college or postsecondary sites using collaborative, project-based learning. Another purpose was to further develop the data collected in Phase I through expanding the pool of participants, visiting new sites, and by using personal interviews to gain the voice of the participants.

Data in Phase II were collected from the following sources: (a) site visits to educational facilities, (b) observations of learning processes, (c) participation in conferences and activities, (d) personal, audio-taped interviews, and (e) personal, electronic mail interviews. To maintain confidentiality of the participants, who were interviewed, they were given alphanumeric codes (e.g., P2A1). The "P2" indicates Phase II, the "A" refers to a particular participant, and the "1" indicates the first of two main events in the phase in which personal interviews were conducted.

The design features identified in Phase II were coded similarly to Phase I (e.g., F1,2) indicating Feature 1, Phase II. The feature number remains the same throughout the study, although modifications and additions to titles, descriptions, and purposes for each feature were incorporated as they emerged.

Phase II was organized by event and sub-event. The two main events of Phase II were: (a) attending a conference session on collaborative, project-based learning at the community college level and interviewing two of the presenters and (b) attending an conference on innovative learning environments. The second event had the following sub-events: (a) a pre-conference workshop, (b) tours of educational facilities, (c) case studies, and (d) a workshop. Personal interviews were conducted in both events to expand the participant pool of the study and to add breadth and depth to the data.

The first event was participation in a national conference session, titled High Performance Student Work Teams Deliver Powerful Training Solutions, held at the annual conference of the National Council of Occupational Educators (NCOE). The session demonstrated one community college's efforts to address a major enrollment increase by exploring options of delivering curriculum using different learning processes. One process being explored was the use of collaborative, project-based learning to provide service learning opportunities for the learners and from which the college gained ways to connect with the growing community. After the session, I conducted informal audio-taped interviews of two of the three presenters to ask about: (a) the benefits of collaborative, project-based learning, and (b) the design features of the physical learning environment that supported and enhanced the use of collaborative, project-based learning.

The second event was participation in an international conference, Innovative Alternatives in Learning Environments that provided opportunities for site visits in The Netherlands to [postsecondary] educational facilities, some of which used collaborative, project-based learning processes. After spending a week developing professional relationships with several of the educators and architects attending the conference, I subsequently invited several of them to participate in the study. Additionally, I attended a workshop at the conference that brought architects and educators together in an intense time frame to design space for learning. The workshop provided insight into my initial thinking of who to have as participants for and how to design the design studio, which was Phase III of this study. From participating in and observing the process used for the workshop, I determined what parts of the process to use and what things to change in the design studio.

Findings from National Conference Participation

While attending the 2000 Annual NCOE conference held in Denver, Colorado in October, I participated in a session about project-based learning being used as a service learning tool for the benefit of the learners and the college. High Performance Student Work Teams Deliver Powerful Training Solutions was presented by two faculty members and one administrator from Tomball Community College (TCC) in Houston, Texas. Following the session, I conducted informal audiotaped interviews with two of the presenters of the session, who were identified in the study as P2A1 and P2B1 for the purpose of the study.

Tomball Community College is one of four colleges in the North Harris Montgomery Community College District and was in the midst of a 33 percent enrollment increase. Tomball is a comprehensive community college that serves learners ranging from those seeking basic education skills, gaining career and life skills, and those continuing to a four-year college or university experience. Tomball

Community College was exploring different methods in delivering curriculum in ways to better prepare the learners and seeking ways to increase efficiency to serve the most students with the same facilities and funding levels. According to presenter P2A1, "This tremendous increase in enrollment caused the College to tear up old ideas and to look at their curriculum and facilities differently."

One of the classes offered in the Business Core at the college was High Performance Work Teams. In the conference session, it was explained that in the High Performance class, the learners: (a) applied team concepts to real-life situations, (b) integrated interpersonal skills, group dynamics, and leadership activities in the work team, and (c) effectively applied group participation and problem-solving techniques. The learning occurred through collaborative, project-based learning and incorporated the concept of service learning, both of which provided the opportunity for learners to practice the skills they were learning.

In some project-based learning activities, students have the opportunity to choose projects that are relevant and meaningful to them; however, for the High Performance class, the college selected the project because the class was designed to produce a service that would benefit TCC as well as the learners. When asked if the learners objected to not being able to choose the project, one of the presenters explained that by being assigned a project, the learners came to understand better how work is assigned in the workplace.

> They [the students] have to learn what it is like to work for someone else who will be telling them what they need to be producing. They may not like it, but they still need to do their best and produce what is asked. Realness of the project comes through creating a sense of urgency and discomfort. (P2B1)

To further emulate a real work situation, the learners in the class were given a written description of what tasks needed to be accomplished for each project. The tasks included: (a) expected deliverables, (b) accurate timelines, and (c) appropriate rewards and consequences for finishing or not finishing the project. Prior to starting the project, the learners received training on problem solving, decision making, and communication skills. The learners were given the tangible support (F20,2) they needed (e.g., supplies [F22,2], space [F13,2], use of telephone/copier/fax [F9,2], and coaching [F21,2]). In addition to learning how to work in teams to produce a product, the students gained skills in using available technology to enhance the development of the product as well as to deliver the service.

During the conference session, I asked the presenters to describe the physical learning environment in which the current course was being offered. Their responses indicated that the traditional, lecture-based classrooms were the only available spaces and worked for collaborative, project-based learning as best they could with minor adjustments made by the students. In the subsequent personal interviews, I asked the question again seeking to see if their responses would have changed after thinking about the earlier question and being able to answer privately and not in a conference session.

Design Features of the Physical Learning Environment

In the interviews with both presenters, I asked each of them to describe how they would design the physical environment for project-based learning and what features were needed in that environment. Individually, and yet almost identically, they both talked about walking into their existing classrooms and seeing the tables and chairs all pushed up against the walls (F7,2) and finding the learners working on the floor (F4,2). Seeing this, both participants stressed the need for furniture that can be easily reconfigured (F7,2) according to the needs of the learners and the activities.

Presenter P2B1 described the ideal project-based space as "having civilized amenities like what you would find in an office or a work space." The amenities or features of the physical environment as described by P2B included: (a) telephones, (b) fax machine, (d) copier, (d) ability to plug in laptops at each table, (e) access to the Internet (F9,2), (f) differentially sized tables or work surfaces to accommodate different sized projects (F7,2), (g) places to sit on the floor (F4,2), (h) seating for groups (F14,2), (i) presentation areas (F6,2), (j) a laptop teaching station (F9,2), and (k) access to food and beverages (F29,2). In the current spaces at the college, "...we have tables, chairs, and a desk. The teacher has to bring the scissors, tape, and stapler—all those little things so they can take what they are working on and do something with it" (P2B1).

Presenter P2A1 added the following additional features to a project-based physical learning environment: (a) good lighting, including track or task lighting and a light table (F30,2), and (b) an adjacent space (F20,2) that is similar to what you find in an ambassador club at the airlines. While further describing the space in an airline club, P2A1 said:

> They are the best models for individual breakout spaces and for smaller scale collaborative type activities. This space may not be conducive for a class, but would be for individual teams (F16,2) to meet and to establish a learning activity. It would be more like a learning center where they have access to technology and resources and where they actually produce a product. (P2A1)

At the end of the interview with Participant P2A1, I took the opportunity to query who should be involved in the design of physical learning environments. I had been thinking about the selection of participants for the design studio in Phase III of the study and that if we are building spaces for learners, should they not be involved in the design and decision making? When I asked P2A1 if learners were involved in their design processes, the answer was "one." The Participant went on to say:

> I think it is a good idea to have students involved when discussing student spaces and open spaces. They can give you ideas for how they would like to see things arranged. For classrooms, I really can't say, and yet my experience of going into the classrooms and finding the tables and chairs (F4 & 7,2) shoved against the walls would say that students probably do have ideas of how they want their spaces to work for their projects. (P2A1)

The conference session and interviews prepared me for the next event of Phase II by giving a base line of features that support and enhance collaborative, project-based learning to seek and observe while on the site tours at the Innovative Alternatives in Learning Environments conference. Additionally, I had further refined the interview questions for the participants of the second event to gain further insight into the two foci of the study.

Findings from International Conference Participation

The Innovative Alternatives in Learning Environments conference was held November 6-11, 2000, in Amsterdam, The Netherlands. The conference venues were many and varied in scope from a pre-conference workshop to site tours of educational facilities, conference sessions, and a post-conference site tour.

Pre-conference Workshop

DHV, Consultants for Accommodation and Real Estate, in Amersfoort, The Netherlands, sponsored a one-day pre-conference workshop for a group of Dutch architects. Bruce Jilk, KKE Architects and chair of the conference, and George H. Copa, Professor at Oregon State University, were the presenters. Some of the architects at the pre-conference workshop had previously worked with Jilk and Copa and organized the workshop as a briefing of the presenters' newest thinking related to designing educational environments and to have an opportunity for in-depth discussion. Only the direct statements related to the focus areas of the study are included in the findings.

According to Copa (pre-conference workshop, November 6, 2000) education is in the process of evolving from being classroom-based to a broader learning system that involves a broad network of people providing learning opportunities (F1,2). In moving to a learning system, the thinking, planning, and designing of learning facilities changes from being teacher-centered to learner-centered and from being building-based to one of a more community-based model. As an analogy, Copa told of how the telephone companies did not change the features of the telephone booth, but instead developed the cell phone. Using this analogy, Copa then asked, "What do learning environments need to be now and for the future?"

In the areas of work, family, and community, people need to have the following skills: (a) be more proficient as team members, problem solvers, producers of goods and services, and (b) contribute to a diverse and global economy. Copa's next query was, "Do our current educational facilities restrain the type of learning that needs to be taking place to teach these skills?" Copa advocated that the learning space needs to be able to change quickly and easily (F4,2) from moment to moment, day to day, and program to program to be maximized in usefulness. Jilk (pre-conference workshop November 6, 2000) advocated that the built learning environment should provide a sense of the following things: (a) one's own space (F17,2), (b) connection with others (F10,2), (c) meaningfulness, and (f) relevancy to the world.

Another aspect of learning that needs to change is the way learning is organized by the more common time frame of 50-minute class periods. Collaborative, project-based learning needs to be organized around longer blocks of time for learning and to access both formal and informal learning events that facilitate development of the project. Copa asked, "How would these things impact the scale of the learning spaces and the buildings in general?"

When new designs for physical learning environments is advocated, the concern of adequate resources to build these new environments is frequently voiced. Developing strong partnerships with other learning providers, agencies, and with business is one avenue to address the resource concern. According to Copa, partnerships help provide the additional resources needed to build facilities that are used by the school, college, or university and by the community partners. The mixed-use concept creates new sources of revenue.

Additional examples of education/community partnerships given by Copa, were: (a) the North Harris Montgomery Community College District in Houston, Texas, seeing itself as building an electronic network between local school districts, community members, agencies, and businesses rather than building single buildings or campuses and (b) the Advanced Printing Technology Center at the Hong Kong Institute of Vocational Education where prototyping and production activities are used for learning, providing service to the community, and generating resources. The pre-conference workshop reinforced: (a) the need to create a learning system that provides relevant and meaningful learning opportunities with the help of partnerships and (b) the need to look beyond traditional thinking and models of how to deliver learning.

Site Tours

The conference included site tours during and after the conference. The participants chose from several tours, each including educational facilities for all levels of learning and urban development or re-development projects in Amsterdam and several other cities. The site tours provided visual exposure to the concepts and work of various architects and stimulated more questions in my mind related to this study. The tours were to the following sites:

1. Utrecht University where the group toured four recently constructed educational facilities designed by noted Dutch architects Rem Koolhaas, Neutelings Riedijk, and the Mecanoo Architekten firm. I noted that the building spaces ranged from cavernous rooms with rows of desks used mainly for the purpose of testing, to a variety of group instruction spaces, to informal learning and gathering spaces.

2. Several other educational facilities, ranging from kindergarten programs to postsecondary sites were toured. Some of the facilities were stand-alone buildings in urban and suburban areas and others were located within housing and business areas in and around Amsterdam and Rotterdam.

✓ 3. The town of Hilversum to observe how significant growth in a town was planned for in such a way as to meet current and future needs of the residents. The significant growth of the town occurred in the 1920's, and W. M. Dudok, an architect, was hired to develop the city plan. He designed several of the public buildings and parks facilities in the city, including his well-known Town Hall and several educational facilities that have served as models for school buildings in the United States.

The significance of Dudok's structures is two fold: (a) the design and features stay relevant regardless of the changes seen in society and the city since they were built 80 some years ago, and (b) the design allows the facilities to be used for other purposes without extensive renovation. Two examples of design features that he placed in his buildings that are both functional and aesthetic are: (a) the extensive use of windows (F8,2) to incorporate natural lighting in as many ways as possible and (b) circulation patterns (F10,2) that encourage movement between and integration of activities in a non-disruptive way. He included these features long before they became more main stream in designs years later. The furnishings in these buildings looked and functioned as well today as they did eighty years ago.

Conference

The conference was held at the Hogeschool van Amsterdam, a university for professional education at which the primary learning process being used was project-based learning. According to Tom DeGraff, who led the design planning team for this university site, the focus of the university was based on how to learn as well as acquiring knowledge. In recognizing that 40 percent of the students failed their first year and that 80 percent of those students fell behind within the first three months of school, the university: (a) organized the teaching staff into teams (F22,2); (b) organized the learners into teams (F16,2); (c) designed the learning spaces to keep the faculty close to students and provided shared teacher-student spaces (F20,2); and (d) used project-based learning as the primary learning process. The majority of the learning spaces were open working spaces that incorporated small group space (F14,2), laboratory space (F2,2), and project space (F13,2). Support areas included: (a) the library/media center (F9,2), (b) cafeterias (F29,2), (c) large common spaces (F3,2), and (d) computer laboratories (F9,2).

Another postsecondary site that I toured was Icthus College in Rotterdam. The design features of the college relevant to this study were: (a) large, open common spaces (F3,2), (b) access to food and beverage at all times (F29,2), (c) access to technology and resources (F9,2), (d) small group spaces (F14,2) interspersed through-out the building that provided individual and team work stations, and (e) areas of high flexibility (F4,2) in rearranging the learning space quickly to accommodate changing learning activities.

From touring the various facilities, I either gained new insights into or reinforced previously gained insights about the design of physical learning environments and the features of those physical environments. The site tours and conference sessions provided the time and conversations to develop deeper relationships with several of the conference attendees, some of whom became participants in the study. I had originally planned to conduct audiotaped interviews with selected participants while at the conference, but the intensity of the conference activities precluded that option.

Electronic Mail Interviews

After returning to the United States, I used electronic mail to invite 29 of the attendees to participate in electronic mail interviews. The 29 included some of the conference presenters and workshop facilitators and those with whom I spent more time with during the week. Eleven initially responded, and eight gave consent and participated. Five were from the United States, and two were from The Netherlands, and one from Israel. One of the eleven who responded is not currently involved in designing educational facilities so excused himself from participating. The second of the eleven who initially responded is a university faculty member who upon returning to campus finally excused herself because of time issues, and the third of the eleven continued electronic mail discussions but did not answer the questions that were presented. The participants interviewed during this second main event of Phase II were coded similarly to those in the first event with the exception of adding a second numeral two to indicate the participant was from the second event (e.g., P2F2). Th "P2" indicates Phase II, the "F" labels the participant, and the last "2" denotes the second of the two main events in the phase.

I asked the participants four questions. Questions 1, 2, and 3 were focused more on the challenges of the design process used for educational facilities. Those questions were informational and only the comments made that were specific to the focus areas of the study were included in the findings. Four Participants noted the challenge of inadequate funding for building learning facilities in general and specifically for spaces that were traditionally viewed as non-learning spaces.

> Being able to sell the need for "student space [non-classroom]" (F27.2) for interaction and learning is difficult when funding is so often lacking or inadequate. In a construction market where costs are escalating dramatically and without defined parameters, anything outside of basic and known teaching services are often the victims of "value engineering" or lack of vision with administrators. (P2C2)

Participant P2B2 described a project in which funding of non-classroom space became an issue with funding agencies. The project was for a proposed addition parallel to an existing vocational, one-story, traditional shop area and a recently renovated, computer-based technology lab. The college faculty and administration supported the idea, but it was difficult to gain approval from funding agents.

> When we suggested moving the addition closer to the vocational building and roofing over the space between the buildings to provide a high-bay, flexible student project space adjacent to both the vocational shop spaces and the technology space, the faculty and administration were excited. After two intense meetings, the state construction office allowed the design to proceed, but would not provide funding for it, since it was not a "classroom. (P2B2)

Participant P2F2 corroborated the above challenge stating that "...although the notion of interactive learning environments being more expensive and less efficient is generally false, it is a belief that is somewhat pervasive in many institutions and in the voters' and legislators' minds."

Question 4 asked, "What are the key features of space designed for active learning, specifically for collaborative, project-based learning"? The three areas that emerged from the question were: (a) needing flexible and multiple-use spaces (F4,2), (b) providing a sense of ownership (F23,2), and (c) recognizing the use of non-classroom spaces for learning (F27,2).

Flexible Spaces. All the participants mentioned the need for flexible spaces as a key feature for the physical environment for collaborative, project-based learning.

> Flexibility! The environment must be capable of adapting quickly to changes in the learning process. Flexibility can mean many things, but the simplest method is to create places where different activities can occur within the boundaries of the same space (F4,2). (P2F2)

Participant P2C2 said that, "...the project-based model typically requires greater flexibility for technology and furniture arrangements (F7,2) [than for spaces using other learning process]."

In describing the desired features of collaborative, project-based learning environments, Participant P2B2 included flexible, comfortable furniture (F7,2), computers, Internet connections, and library materials (F9,2).

> [Generally] this space will serve both as places where individual (F17,2) and small-group (F14,2) project work can be carried out in close proximity (F20,2) to the faculty, and as meeting places where serendipitous interactions (F27,2) among students and faculty can

> occur, enhancing the learning process. [Specifically] a collection of spaces ranged from large, open, high-bay 'shop type' space (F31,2) to more traditional lab[oratory] space (F2,2) to 'clean room' space (F32,2) to large (F15,2) and small group (F14,2) meeting areas, to 'study houses' (F11, 2) and 'slump' spaces (F33,2) for the planned a serendipitous meetings, which often generate synergy and new ideas. (P2B2)
>
> The space and its features are totally dependent on the intended use and program. If the program is not specific and does not require obviously unique features such as a hydroponics program would, it would seem that creating a space that is generic and flexible would be important. A space that could adapt as the program changes and becomes more defined or a different program is added to the curriculum (F28,2). (P2A2)

Sense of Ownership. Three of the participants emphasized the need for a sense of ownership (F23,2) by the user in the design of flexible spaces.

> The biggest issue with using a space for multiple types of learning activities is the loss of ownership by the instructor and the students. If it is used by many, no one person feels a need to connect with the space and make it a part of their pedagogy. This is the biggest complaint we hear about flexible, multi-use space. Human beings have a need for identity. Creating places where we are treated anonymously generally creates a feeling of disconnection and a need to "mark" their presence within that space. This usually expresses itself as vandalism. (P2F2)
>
> The student shall feel at home (F23,2), students have their own space (F17,2), the space is for and of them. Teachers also will have their own, protected space for developing work (F21,2). (P2G2)
>
> Let the environment pay respect to the student, then the students will be proud of their building, their company, and their results. Make a dull environment and the students will have less motivation, demolish things, etc. Teams of students occupy their own part of the building; they have to identify themselves (F23,2) with it. The human scale must reflect on the environment, not the economic or organizational scale. (P2H2)

Non-Classroom Spaces. Two of the participants mentioned that the key to designing spaces for active learning processes such as collaborative, project-based learning is to, "look at the 'spaces between'" (P2E2).

> In other words, find ways that the non-traditional, non-classroom (F27,2) areas can support the learning process. In our own work environments, the most important discussions do not take place at our desks, but in the lunchroom, library, stairs, or lobby. We treat the schools the same way. Wherever possible, we provide opportunities for students to sit in hallways and lobbies with access to daylight and technology (high tech data/voice/video and low tech whiteboards). (P2E2)
>
> Success is not only in the labs [laboratories] (F2,2) or in the classrooms (F12,2), but also on the "edges" (F27,2), where the interaction takes place. These can be lounges, simple benches, marker board areas, study areas, etc. Breakout space is needed adjacent (F20,2) to the rooms for smaller groups to work. This needs to be a programmable space, as without it, the facility will lack the energy and soul it will require to be successful. The vitality of programs depends on the support the new environment gives to interaction amongst and between the students, faculty, administration, and the community. (P2C2)

The described features given by the Participants of the electronic mail interviews further reinforced the findings of Phase I of the study and the first event of Phase II. For the purposes of gathering more data for the study, other activities at the Innovative Alternatives conference were rich sources of information. The additional activities included: (a) conference general sessions, (b) case studies, (c) and a workshop on designing space.

Conference General Sessions

In his opening remarks for his keynote address, Herman Hertzberger, an architect and professor from The Netherlands, reminded the audience that the "old" thinking about learning was that learners were pumped full of knowledge and that truth came from blackboards. The "new" thinking is that learning is not just about acquiring knowledge and skills, but also gaining an understanding about attitudes, behavior, and communication by learning in an environment similar to living and working environments.

The environments designed by Hertzberger have no traditional corridors, but are designed like streets (F10,2) with sidewalk cafes; only that these cafes are for learning. He prefers designing around city squares or city plazas (F3,2) with houses or villas of learning surrounding these central gathering places. These plazas or squares are places to learn and to discover. When separations are necessary, Dutch doors (F10,2) can be used to provide the separateness, but are also used to retain connection.

One of the more insightful concepts that I learned from his address was that the design of space organizes and encourages behaviors. Spaces give the messages of "welcome," " walk here," " sit here," and "discover here." Space designed for expected behaviors reduces the need for creating and posting rules.

Case Studies

The conference provided several case studies of innovative alternatives in learning environments. I have gone into more depth in the case studies that were most pertinent to the foci of this study. The titles of the case studies were those given by the presenters.

Case Study 1 -- Open and Flexible Learning Spaces [Heinavaara Elementary School]. Reino Tapaninen as Chief Architect of the National Board of Education in Helsinki, Finland, opened his remarks for the case study with a presentation slide showing a line of "identical blockheads" emerging in a straight line from a "block" school building. Recognizing that learning needs to be taking place differently for societal and economical reasons, Finland had changed its educational system to be learner centered, cooperative, and project-based.

The Heinavaara Elementary School was designed two years ago through a cooperative agreement between Finnish architects and Cuningham Group, led by Bruce Jilk. The school is located north of Helsinki and is designed for 190 learners. According to Tapaninen, learners are involved with projects all day long. The learners learn, study, and assess together and proceed at their own levels. They work in small and large groups, use technology to access information, have panel discussions and assemblies, create displays, and give presentations.

Recognizing that schools also provide a place for social growth, Heinavaara Elementary was designed to be a place that learners: (a) bonded with, (b) belonged to, (c) met with peers, and (d) took part in the learning process and life together. The spaces allow for different sized groups (F4,2), have laboratories for experimentation (F2,2), and have individual workspaces (F17,2). Teachers learn and experiment with the learners and are located (F20,2) in the middle of the learning spaces. In keeping with the nature of projects, dining was available in small "cafes" (F29,2) that are open all day with no prescribed times to eat.

Design Features of the Physical Environment

According to Tapaninen, flexibility (F4,2), openness (F3,2), and visibility of learning at Heinavaara (F8,2) result from designing the facility around a central resource area. There are student sharing spaces (F27,2), like gazebos, only for the learners. Production of information and projects occur in large open spaces rather than in rooms separated by corridors. Comfortable and versatile furniture (F7,2), and soft and inviting lighting (F30,2) are important features that support learner centered, collaborative, project-based learning.

An urban environment was created in the design of the school. The outside entrance was designed like a city square to provide a gathering space (F3,2). From this square, each workshop area had its own outside entrance or the learners could enter through the main door and pass (F10,2) by a large hearth at the center of the plaza. The hearth provided a "warm start" to the day. From the plaza (F3,2), there were streets (F10,2) with cafes, net surfing and media bars (F9,2); and a large information resource area. The streets lead to the workshop spaces (F13,2). The building is also used a learning tool (F26,2) in that the night sky is painted on the ceiling and signage in the building is written using other languages.

Case Study 2 -- Designing a Place for Problem Solving: The Center for √ *Applied Technology and Career Exploration.* Daniel Duke, professor of educational leadership and the director of the Thomas Jefferson Center for Educational Design at the University of Virginia, began his presentation with a story about one of the site tours from the previous evening. After visiting a K-8 Montessori School in Amsterdam, the tour bus was unable to maneuver a street corner due to a parked car. There were no alternate routes. To solve the problem, the bus driver asked for six volunteers to get out of the bus, lift the car, and place it on the sidewalk, thus, giving the bus enough room to get around the corner. Duke asked the conference participants, "Can we do this for education reform?"

Four years ago, the community of Rocky Mount, Virginia, needed to address a high dropout rate and at the same time needed a new middle school. The new middle school was designed as a Center for Applied Technology and Career Exploration. The per capital income for the region was less than $16,000; forty percent of the adults had less than a high school diploma, and 32 percent of the students were eligible for free lunches. The preference would have been to build a traditional middle school for 1000 learners. The cost would have been $14 million dollars, but the community had passed a $7 million dollar bond.

Duke explained that the educators and community recognized the 8th grade is a crucial year and often is the time of "losing them [the students]" from the school system. Through a community-based design process, the community created a school focused on career clusters and project-based learning. The aspiration was to keep the learners in school and to begin to prepare them for careers.

Because of the funding limitation, it was decided to build a school for 500 learners. Half of the middle school students would attend the school for half of the year. The other 500 learners would remain at the existing school. The groups switch locations mid-year. During the 18-week semester at the Center for Applied Technology and Career Exploration, each learner selects three, six-week career modules. The learner spends each day of the six-week period in that module.

The learning is based on real community issues that need to be solved. The learners present her/his findings to community agencies, local governments, and to boards. The modules provide team learning, problem solving, improved oral and written communication skills, clarification of career paths, and the opportunity to develop a work ethic comprised of responsibility, initiative, and dependability.

Design Features of the Physical Environment

Duke explained the school is designed as a center (F3,2) with no traditional classrooms, laboratories, cafeteria, or gym. There is an electronic library, one computer per two learners (F9,2), individual workstations rather than desks (F17,2), a commons that provides food service (F29,2) for a three-hour time block to better accommodate the problem-based learning process, storage (F22,2) in each workstation, and access to the local YMCA (F1,2) for physical fitness activities (F24,2).

Case Study 3 -- Designing for the Unknown. [Alpha High School]. Norm Dull, architect with Dull Olson Weeks, described the dilemma of designing learning facilities for a future that is unknown. Educators request facilities that are flexible and adaptable in hopes of gaining a facility that will be as usable in thirty years as it is today. One high school his firm designed is Alpha High School (AHS) in Gresham, Oregon, in the Portland Metropolitan area. Alpha High School is an alternative high school designed around the needs of the learners. Two goals for the learners are: (a) to develop a positive self-image, and (b) to gain skills necessary to be employed upon graduation.

For half of the day the learners are at Alpha High School taking academic courses to graduate, and the other half of the day the learners are at a work site. As much as possible, the curricula for the academic courses is designed using projects or service learning. The projects range from growing plants for a stream restoration in a National Forest to learning about running a small business such as video production or bicycle repair. Over 200 business partners come into the school to provide guidance and school-to-work experiences. The school also has space for small business incubators in which the learners are given the opportunity to observe and participate in the business.

Design Features of the Physical Environment

Dull pointed out the most impressive design feature of AHS is the ability to move all the walls and cabinetry (F4,2) in the learning portions of both floors. Learning spaces can be created for groups as small as 10 and the total area can be opened up to house over 200 people. The administrative area of the school can be secured so that the facility can be used by others in the evenings and weekends.

Two other noticeable design features about the AHS that differs from the traditional comprehensive high school are: (a) the lack of a large parking lot and (b) its small size. Not much parking area is needed because the learners and community users have easy access to public transportation with AHS being located next to light-rail and bus lines. Again, the size of the AHS remains small with having just half of the learner population at the facility at one time, while the other half are at work sites.

The design does not include a traditional library, cafeteria, or a gymnasium. Alpha High School partners (F1,2) with the public library, which is located a few blocks away and because the learners are at the facility only half of the day, they do not need full meal service provided on-site or an onsite gymnasium. There is a snack center with vending machines and a microwave to heat food (F29,2). Alpha

High School is the cornerstone of an urban redevelopment project in Gresham, Oregon, and is used as a community center in the evenings and weekends by local Senior Centers and Mt. Hood Community College.

The Space Workshop

Six design theme workshops held at the conference were: (a) Location, (b) Space, (c) Time, (d) Scale, (e) Cost, and (f) Context. I participated in the Space Workshop and explain the process of the workshop in the study because it served to guide the design of Phase III of this study. I also describe the features of the physical learning environment that were identified during the workshop that were pertinent to this study.

The description of the Space Workshop read, "…the basic building block of a school design has been the classroom, a setting supportive of lecture-style instruction." The question given to the workshop participants was, "How should the spaces for learning be designed to accommodate new learning approaches, specifically for the Study House concept?" The Study House (F11,2) concept (Meijer, 1996), was developed in the early 1990's by the Dutch Ministry of Education, Culture, and Science in response to education reform and implemented in 1997. The Study House prepares learners at the secondary level to enter a bachelor's degree level university in The Netherlands and accommodates both academic and vocational opportunities. The concept develops critical thinking, relevancy to the learning, and responsibility for planning one's own learning by: (a) working on projects more independently and in small groups and (b) teachers being more of a coach than an instructor. The physical learning environment to support a

Study House includes spaces of varying sizes to support teacher/faculty-led instruction, individual work, small and large group work, project work, and access to technology and other resources. Elly Reinders, Jan Wagemaker, and Jeff Lackney were the workshop facilitators.

Design Process. The process began with a question to the workshop participants to think back to a successful learning experience and to make note of the following things: (a) what was the learning experience, (b) what activity was occurring, (c) where were they, and (d) who were they with. The workshop participants discussed their experiences with the others at the table, wrote the information from the above questions on large sheets of paper, posted the sheets of paper on the wall, and the workshop group discussed the experiences looking for common patterns or themes. The facilitators of the workshop analyzed the information and determined that 77 percent of the listed learning experiences took place outside of school-based learning activities and settings.

To further stimulate the workshop participants' thinking about educational experiences, video clips from The Dead Poet's Society movie were shown. The movie was about a residential college preparatory school for young men. The clips included scenes depicting the structure of the school's physical setting, social structures, learning practices, and a parent's influence on a young person's educational and life choices.

The workshop participants self-formed into three groups and were asked to design a space for a "Study House." As each group began the process, the facilitators became aware that the groups were each and collectively resisting the assignment. The groups wanted to focus on the philosophical concept of whole communities becoming learning communities, taking the learning out into the community, and bringing the community into the learning process rather than focus on designing a particular type of facility or a singular concept. The facilitators allowed the groups to proceed in the new direction and also noted that each group had developed its own process to complete the assignment. The facilitators named the three groups: (a) the "verbal group" [that wanted to talk and talk], (b) the "kinesthetic group" [who wanted to begin to design immediately], and (c) the "future group" [who began with an initial discussion of what learning may be like in the future and then moved into the design phase].

After the majority of the time being spent in discussion, the verbal group in which I participated, produced three learning diagrams in the last ninety minutes before the report-out session to the whole conference. The first diagram illustrated the development of the learning process along the age spectrum from birth to high school. The group member who drew the diagram explained that in his view, learning initially started in a contained, fairly safe, box-like, environment and through elementary education a few holes and tears began to appear in the box as the learner discovered more knowledge. By middle school one or two sides of the box had been kicked out and by graduation from high school, it was his hope that all four sides would have been flattened.

The second diagram showed the dynamic links (F10,2) between learning sites all over the city or geographic area. The connections varied with some being one-way, others were two-way, some were formal and others were informal links.

Wanting to develop a more in-depth learning community, the third diagram (Figure 2.) had four "streets" or "pathways." The intersection of the four streets was a basic core learning area with resources, media, computers (F9,2), and staff. In each of the four directions from the central learning core was one of the following learning spaces: (a) personal spaces (F17,2) for students and the community; (b) project-group spaces (F13,2); (c) exploratory spaces for science, equipment, and technologies (F2,2); and (d) social experience and activities spaces (F27,2). The diagram showed direct flow in and out of all of the spaces, using wireless and Internet technologies (F9,2), community providers as teachers (F1,2), and learning staff going out into the community. The social experience and activities area also provided community support services and a basic commons area for the community, learners, and staff.

The kinesthetic group built a three-dimensional model using construction paper and added accessories to simulate the built environment. The learning community was built around and into a lake, using the lake as one pod for learning. The learning was interdisciplinary with a multicultural, multidirectional, and whole community focus.

The future group looked to the year 2025 and created a learning village within one structure. The structure housed cinemas, markets, cafes, offices, meeting spaces all providing a sense of "voyeurism" (F8,2) into the learning spaces and process taking place in the village.

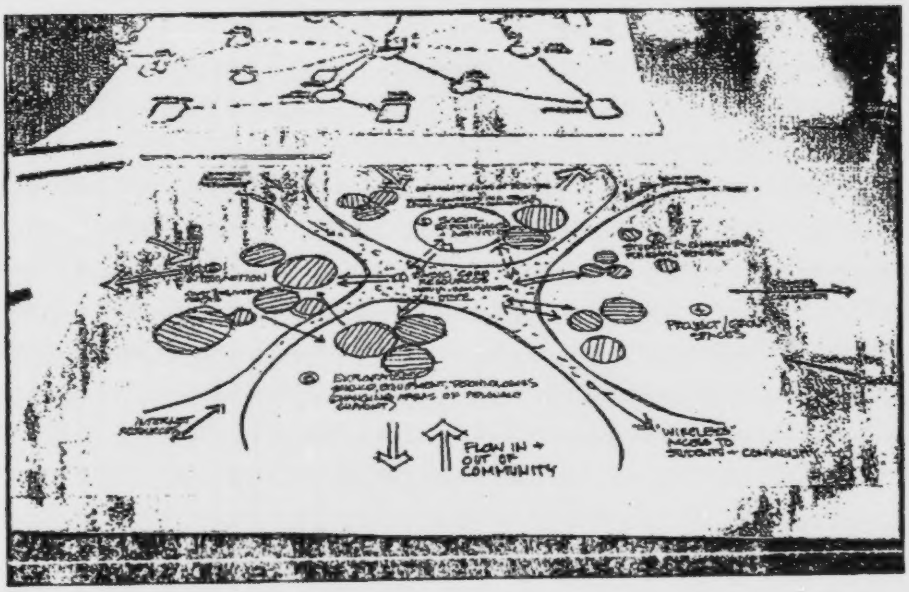
PROJECT/GROUP SPACES
"WIRELESS" ACCESS TO STUDENTS + COMMUNITY
FLOW IN + OUT OF COMMUNITY

Figure 2. Learning Community Diagram.

The process used in the Space Workshop illustrated that in a relatively short time frame, it was possible to have a small group of people, who basically did not know one another, but all of whom had knowledge and experience in education and/or architecture, to do the following three things: (a) produce insightful designs, (b) identify the features of the design, and (c) provide insight into the thinking behind the selection of the features into the design process itself. Another learning experience from the Space Workshop that I applied to Phase III of the study was the participant group might want to change the assignment to what is most pertinent for them at the time. The importance of the lesson was as a facilitator of a learning project, it is crucial to recognize when to deviate from the planned process and agenda and let the group's work flow.

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Summary of Phase II

Participating in the conference session at the NCOE conference and conducting the follow-up interviews with two of the presenters enhanced what I had learned from the literature review about active learning processes, specifically, how project-based learning prepares learners for the 21st century. The conference session also provided a deeper insight into what physical design features support and enhance collaborative, project-based learning. The data collected in the first event of Phase II reinforced and expanded the findings of Phase I. The Innovative Alternatives in Learning Environments conference provided extensive and meaningful data for the study. The data gathered at all of the activities at this conference enriched the data from Phase I and the first event of Phase II.

Phase I of the study explored active learning processes and began to concentrate on collaborative, project-based learning. The events of the Phase I took place at both the K-12 and community college levels. The purpose of Phase II of the study was to narrow the inquiry to collaborative, project-based learning at the community college level and develop further knowledge of the two foci of the study.

Analysis of Phase II

The resulting analysis of the findings shown in Table 3 uses the same basic format and labeling as was used for the analysis of Phase I in Table 2. To show the developing responses to each foci of the study and to illustrate the emerging patterns of features, Table 3 includes the analysis of findings from both Phase I and

Phase II. The title and description of each feature relates to the first foci of the study, the design features, and the purpose of each feature links to the second foci of the study, the thinking behind the selection of the feature. The analysis from Phase I now appears in italicized typeface and the analysis of data for Phase II appears in regular typeface. Design features numbered one to 28 emerged in Phase I and many were also mentioned by participants in Phase II. Some identified features in Phase I were not identified by participants of Phase II, but remain in the Table. New features discovered in Phase II are numbered 29 to 33.

Table 3 illustrates how the data collected in Phase I were enriched by the findings from Phase II through additional descriptions and purposes for the majority of the features recommended in Phase I. Five new features emerged in Phase II that were not identified in Phase I: (a) access to food and beverage; (b) lighting such as task lighting and light tables; (c) high-bay, shop space (d) technology laboratories; and (e) slump spaces or places to generate synergy, create new ideas, think, and relax. Features recommended in Phase I that were not mentioned in Phase II were: (a) public display space, (b) lockable personal storage, (c) personal display space, and (d) durability.

Table 3

Design Features and Related Rationale of the Physical Environment that Support and Enhance Collaborative, Project-based Learning at the Community College Level from Phases I and II.

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F1,1	*Access to community*	*Use of community, business, and other institutions of learning for space, curriculum, materials, personnel, and funding.*	*Brings relevancy to curriculum and learning. Builds active partnerships between agencies.*	*6*	
F1,2		Broad network of people and settings providing learning opportunities.	Creates a learning system that extends beyond the classroom. Reduces need to build certain components of the physical learning environment by accessing available community resources.		4
F2,1	*Learning laboratories*	*Indoor or outdoor areas for learning science, technology, dance, music, and art projects.*	*Provides space and infrastructure to accommodate specialized equipment for learning activities, develop and practice specialized skills, bring relevancy to the learning process, and provide security of the equipment.*	*6*	
F2,2			Provides learning space for experimentation.		5

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F3,1	*Large, open space*	*Commons, cafeteria, plaza, "town square," auditorium, presentation, and gathering space.*	*Provides for multiple uses of space and ability to gather large numbers of people together.*	2	
F3,2	Center	Central space for learning.	Provides openness in physical learning environment.		7
F4,1	*Flexible spaces*	*Spaces change easily and quickly for new uses or in which several activities can occur at the same time. Can be changed moment to moment and day to day to respond to changing activities (e.g., folding walls, track lighting, moveable furniture and casements, multiple technologies).*	*Encourages and supports integration of courses and programs through the sharing of space and equipment.*	7	
F4,2		Floor spaces for work or sitting.	Increases work surface space and expands boundaries within the same space.		10
		Moveable walls and cabinetry	Provides maximum use of space for multiple purposes and different sized groups.		

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F5,1	*Public display space*	*Tack boards or surfaces, display cases or wall space, galleries, and studios.*	*Provides places and spaces to display work, pictures, and awards to the public.*	*4*	
F5,2					0
F6,1	*Presentation space*	*Auditoriums and stages.*	*Space in which skills and knowledge are presented or demonstrated.*	*3*	
F6,2					1
F7,1	*Moveable, flexible furniture*	*Furniture that can be moved, stacked, and reconfigured easily.*	*Provides versatility in how space can be used to support learners and learning activities.*	*1*	
F7,2	Comfortable, versatile furniture		Provides comfortable and moveable seating for the longer time frames of project-based learning and for flexible use.		7
	Flexible technology arrangements	Technology that can be moved and reconfigured easily.	Supports project-based learning model that requires flexibility in use of space.		

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F8,1	*Interior/ exterior windows*	*Outside windows, glassed garage doors, and window walls.*	*Provides natural light, visibility into the learning areas as well as visibility to the outside, and provides acoustical control.*	*6*	
F8,2			Provides visibility of learning process.		3
F9,1	*Technology*	*Telephone, facsimile machine, copier, TV/VCR, computer, printer, scanner, electrical or electronic tools, and specialized equipment.*	*Provides tools to locate information; produce products, services, and information; and gain skills.*	*9*	
F9,2	Laptop teaching station.	Teaching station with access to wiring to plug in laptop computer.	Increases flexibility of the faculty member to deliver instruction in different spaces.		11
	Library/media resource center	Information resource area.	Provides access to print materials and equipment to receive and deliver instruction.		
	Net-surfing and media bars	Informal computer resource area.	Provides wired and wireless technology for flexibility and convenience for accessing information.		

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F10,1	*Connections*	*Links and circulation patterns among interior spaces and between interior and exterior spaces.*	*Links activities, learners, staff, and the external community as they move from one activity to another. Provides visual connection between spaces.*	4	
F10,2			Provides connection with others. Encourages integration of activities. Provides dynamic links between learning sites throughout the geographic area.		7
	Streets, paths	Pathways with learning areas on each side.	Provides access to learning activities. Connects learners and activities to the outside community and serves to bring the community into the learning institution.		
	Dutch doors	Door in which the top half opens allowing the bottom half to remained closed.	Provides separation and connection.		

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F11,1	*"House" concept*	*A way to organize learners into "smaller" groups that stay together for a period of time up to a year.*	*Provides sense of small school and a learning experience focused on individual or team interests and experiences.*	*2*	
F11,2	"Study House"	A way to organize secondary education level in The Netherlands using clusters of subjects using an integrated approach.	Promotes individual learning plans using project-based learning. Learning takes place independently or in small groups. Teachers are coaches. Academic and vocational programs are organized this way. Develops critical thinking, brings relevancy to the learning, and teaches responsibility for one's own learning.		1
F12,1	*Space for group instruction*	*Room that is designed and furnished to support direct instruction to a group of learners.*	*Provided space to teach topics, skills, or concepts to a group of learners.*	*2*	
F12,2					1

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F13,1	*Project space*	*Space that provides a variety of sizes and shapes of flat surfaces (e.g., tables, benches, floor space) cabinets for supplies and small hand tools, sinks, storage of projects, access to technology (in the same space or an adjacent space), and task lighting.*	*Provides space to produce information, products, and services; practice acquired skills; and duplicate the work environment.*	*4*	
F13,2					3
F14,1	*Small group space*	*Space to accommodate groups of learners ranging in size from 3-15.*	*Used for group study sessions, team meetings, discussions with teachers/faculty, or seminars.*	*3*	
F14,2			Interspersed throughout the building for use by individuals and small groups for project work.		5
F15,1	*Large group space*	*Space to accommodate groups of learners ranging in size from 15-35.*	*Used for multiple purposes for larger groups of learners who are working on projects or similar activities.*	*1*	
F15,2					1

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F16,1	*Team spaces or "pods"*	*A space that accommodates a team of 5-10 learners. Space includes individual desk space, secure storage for personal belongings, team table, work space, and access to technology.*	*Provides personalized work areas for individuals or teams that is "owned" for a time period.*	*2*	
F16,2			Provides space for teams to meet and establish learning activities.		3
F17,1	*Individual study, work, or reflection space*	*Individual learner desk, work station, or workspace.*	*Provides an individual work surface with a display area to personalize the space, secure storage for personal belongings, access to technology, and may or may not be located within a team space or "pod." Provides a quiet space for study, work, and a sense of one's own space.*	*2*	
F17,2					6
F18,1	*Lockable personal storage*	*Secure space within one's own work or study area.*	*Space to secure personal supplies and belongings.*	*1*	
F18,2					0

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F19,1	*Personal display space*	*Tack board or display surface.*	*Surface to display items to personalize work or study space.*	*1*	
F19,2					0
F20,1	*Adjacent spaces*	*Spaces in proximity of one another.*	*Support the development of relationships among learners, faculty, staff, and community members; and encourages integration of learning subjects and processes.*	*5*	
F20,2			Provides close proximity of faculty with learners plus use of shared space.		6
F21,1	*Teaching team space*	*Office suites or teaching team rooms.*	*Space used for planning and preparation of curriculum and materials. In some cases designed to provide direct access of the faculty to the learners and the learning experiences.*	*4*	
F21,2			Provides space for "coaching" learners and their activities. Provides protected space for preparation of learning materials.		2

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F22,1	*Supply/ storage space*	*Space to house large sized or cumbersome supplies or a large inventory of supplies needed for projects.*	*Provides ready access to materials for the learning activities.*	*4*	
F22,2					2
F23,1	*Sense of pride and ownership*	*A space in which users feel "at home," use responsibility, and invite others to the space.*	*Reduces vandalism, theft, and excess wear of the space and features.*	*1*	
F23,2			Provides learners a sense of "home." Learners have to identify themselves with the building. Human beings have a need for identity and to not feel anonymous or disconnected.		4
F24,1	*Practice space*	*Gymnasiums and YMCA.*	*Space to practice skills such as physical fitness, sports, and dance.*	*2*	
F24,2					1
F25,1	*Durability*	*Building material and finishes that withstand heavy, messy use.*	*Allows spaces to be used for planned activities with less concern about damage to surfaces, such as floors.*	*1*	
F25,2					0

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F26,1	*Building as a learning tool*	*Visible infrastructure and mechanical systems.*	*Provides hands-on learning in maintaining systems and relevancy to course work.*	*1*	
F26,2		Signage and graphical images.	Used to teach subject matter such as science and foreign languages		1
F27,1	*Informal learning spaces*	*Non-classroom spaces where learning takes place (e.g., hallways, commons, and study spaces).*	*Provides small study and informal gathering/conference spaces for socializing and informal learning.*	*1*	
F27,2	Edges	Places outside of formal learning spaces where interactions take place.	Provides serendipitous interactions that can lead to creativity and innovation. Supports the formal learning processes.		7
	Gazebos		Provides social spaces just for the learners.		

Table 3, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	Phase II # Times Listed
F28,1	*Adaptability*	*Alteration or change in form or structure to fit new use. Larger infrastructure and space changes that take more effort and time than moment to moment or day to day changes, but are less costly and take less time than major renovations (e.g., de-mountable walls).*	*Ability to make space suitable for future use by means of change or modifications.*	*1*	
F28,2			Adapts as the program changes and becomes more defined or a different program is added to the curriculum.		1
F29,2	Access to food and beverage	Cafeteria, commons, cafes, vending machines or access to a microwave.	Supports project-based learning by providing access to food and beverages at convenient times. Also, duplicates what is found in the work and living environment.	*0*	6
F30,2	Lighting	Task, track, and general lighting of the interior physical spaces	Provide specific type of lighting to support and enhancement learning tasks and to create ambience in certain areas.	*0*	2
F31,2	High bay, shop spaces	Shops that are often termed "messy or dirty."	Provides learning spaces with high ceilings to accommodate specialized equipment and mechanisms for moving heavy or large pieces of equipment.	*0*	1

Table 3, Continued

Code	**Title of the Feature**	**Description of the Feature**	**Purpose of the Feature**	***Phase I # Times Listed***	**Phase II # Times Listed**
F32,2	Clean room spaces	High technology spaces	Provides space for high technology equipment and "clean" processes that require specialized infrastructure and little contamination.	*0*	1
F33,2	"Slump" spaces	Think-tanks and "get-away" spaces	Provides a place to generate synergy, new ideas, rest, and reflection.	*0*	1

The analysis of Phase I included clustering the design features into four preliminary categories of group size, learning activities, adjacencies, and furnishings. The five new features from Phase II fit into the categories as next described. Features F26, building as a learning tool, F31, high-bay, shop space, and F32, technology laboratories were added to the learning activities category. Feature 26 referenced how the infrastructure of the building can be used to teach concepts such as sociology, psychology, mathematics, scientific and environmental principles. Features 31 and 32 described learning spaces with specialized infrastructure and equipment to support learning activities taking place within that space. Feature F30, lighting (e.g., general purpose and task based) was added to the furnishings category as an element to support learning processes.

Further analysis of Phase II identified a new category, which was named psychological and physiological support referring to the human functions that need to be taken care of during the learning process.

Psychological and Physiological Support

The design features put into that category were access to food and beverages (F29) and "slump" spaces (F33). One could argue that all learners need access to food and beverage; however, the participants stated that with collaborative, project-based learning, the activity takes place in longer blocks of time and it could be disruptive to break from the learning at appointed times rather than at natural breaking points. The participant who described "slump spaces" gave then a dual purpose. One was to offer a space similar to a "think tank" that is an energizing space to create ideas. The second purpose was a place for a small group of individuals to get away from formal activities to relax and reflect.

In the analysis of Phase I, feature (F23), sense of pride and ownership, did not fit into any of the categories that emerged in Phase I; however, from further descriptions and purposes being described in Phase II, I placed into the psychological and physiological support category. This decision was based on the psychological aspects of belonging and not feeling anonymous, and needing a space to "own," by personalizing and caring for the area. Features 4 and 29 had not been placed into a category at this phase of the study.

Similar to the analysis and summary processes for data collected in Phase I, the data from Phase II was translated into Table 3 by using the voice of the participants for the titles and descriptions of the features, with minor interpretation from me. The purpose sections of the table were for the most part my voice based upon the meaning I gained from the data and the context within each feature was described.

Steps from Phase II to Phase III of the Study

Phase I was introductory and developed the foci of the study. Phase II began to narrow the data collection specifically to collaborative, project-based learning and searched for more community college or postsecondary sites. The findings and analysis of Phase II added depth and breadth to the descriptions and purposes of the recommended features from Phase I.

The data collection methods in Phase I were observations, participation, notes, and reflection. Phase II added personal interviews to the original methods used to collect further data and to probe participants' thinking in terms of the foci of the study. Phase III of the study was planned as a two-day design studio to bring a new set of participants to the study and to use additional methods for collecting data. These additional methods included: (a) audio recording of selected group discussions, (b) participant journals, (c) group work in the form of text and images from large sheets of paper, (d) designs of physical learning environments created by the participants, and (e) video recording the presentations of the final designs. Individual audiotaped interviews with each participant were conducted, I took notes while observing the participants and the design process they used, and reflected on the data collected.

CHAPTER 6

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FINDINGS AND ANALYSIS OF PHASE III

Phase III of the study was one event, a two-day design studio that I conducted in March 2001, in which five architects and five educators participated. The design studio was held at the former Kennedy Elementary School, in Portland, Oregon. The facility is no longer being used as a school but has been converted into a hotel/conference facility and remains as a community center for the neighborhood. The Kennedy School was chosen because it represented a learning facility and because of the amenities it provided such as lodging, work space with natural lighting, table space, tack and chalk boards, areas for relaxation, and convenient access to food and beverage.

The design studio agenda is shown in Appendix E. In keeping with phenomenological research, slight adjustments were made during the course of the two days. The showing of the movie clips was replaced with a presentation by one of the architects who is nationally and internationally renowned for his forward thinking and his ability to evoke creative thinking in others. Another adjustment to the agenda came at the request of the participants to delay lunch the second day because they wanted to continue the final design presentations and discussion without interruption.

The purpose of Phase III of the study was to advance the response to the two foci of the study that had been obtained in Phases I and II of the study by involving more participants and using additional methods for collecting data. During the internship activities in Phase I of the study, I participated in design processes for physical learning environments at the community college level. Phase III provided another venue to observe and inquire about the processes used by the participants in this phase as they designed physical learning environments for collaborative, project-based learning at the community college level.

The sequence of activities at the design studio was similar to that used in the Space Workshop I participated in during Phase II of the study. The first morning began with personal introductions and a briefing on the purpose and organization of the design studio. Following the briefing on the purpose and organization of the design studio, the participants were asked to reflect back to a project-based learning experience that had gone well for each of them. In the reflection, the participants were asked to include what the project was, where it occurred, with whom, the emotions they experienced, and what they learned from the experience. I formed the participants into three small groups to discuss their individual reflections and then asked each group to share the reflections with the larger group. The purpose of the activity was to move the participants' thinking into the context of project-based learning and for the participants to learn more about each other.

To further stimulate the thinking of the participants, I asked one of the participants, who had done educational facilities design work both nationally and internationally, to do a presentation. The presentation focused on the future of learning in general and more specifically about designing physical learning environments for the future. After the presentation and discussion by the participants, I formed the participants into two teams of five and assigned them the task of designing physical environments that support and enhance collaborative, project-based learning at the community college level. Each team had a mix of architects and educators as members and I placed those who either knew one another or who worked together on separate teams. The teams were free at this point to begin work on the assignment and were reminded there would be a "report out" session mid-afternoon and the final presentation of their designs would begin late morning of the second day.

What began as two teams became three by the morning of the second day. One participant, P3B, asked to take a different tack in the thinking behind and the preparation and presentation of the design. One other participant, the director of science education at a museum, was not able to attend the second day.

The findings of Phase III were organized around the three designs for physical learning environments developed by the participants and includes narrative of the process used by each team to produce a design of the physical learning environment that supports and enhances collaborative, project-based learning. For purposes of clarification of participants' quotes or meanings, I placed my interpretations within brackets. Within each design, the identified design features were coded using a similar scheme as in the findings of Phase I and II. The design features recommended in Phase III are coded with a 3 (e.g., F1,3).

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Findings from Design Studio

The first design (Design #1) produced by participants of Team A used the Kennedy School as a model from which to work. The second design (Design #2) created by participants of Team B was based on a composite of individual projects selected by each member of the team. The third design (Design #3) conceived by Participant P3B illustrated the design process for building physical learning environments using both a historical and a futuristic approach.

Design #1

Participants P3D, P3F, and P3I were collectively identified as Team A. In the words of P3I, "We took a different approach [from Participant P3B]. We took an existing structure, the Kennedy School as it is now, and made it into a 200 student community college for the neighborhood." The Team named the college the "Learning Village" and felt very strongly that the design and the functionality of the building needed to reflect the community (F1,3) in which it was located.

> We wanted to keep the building in the context of the community. It is a community college for 200 students. You can't build machine shops here, but our idea is that type of learning can be done in the greater community (F1,3) through cooperative education and apprenticeships. We felt it was important to stay with the history of the building and the neighborhood. It is important to retain the spirit of the building because it belongs to the community. The community areas will have open access. It is important to integrate with the neighborhood (F10,3). (P3D)

In recognizing that the design and functionality may change over time, as the neighborhood's needs change, Participant P3I explained that "This design would have to be tested [for its functionality], [and] it could be used as a model. It shows the evolution and transformation (F28,3) of a model to satisfy the requirements. It is built in increments [as new functions are brought in] and in layers (F34,3) [as community needs change]. This is a schematic diagram and over time would evolve (F28,3) into good use of space to create a collaborative environment."

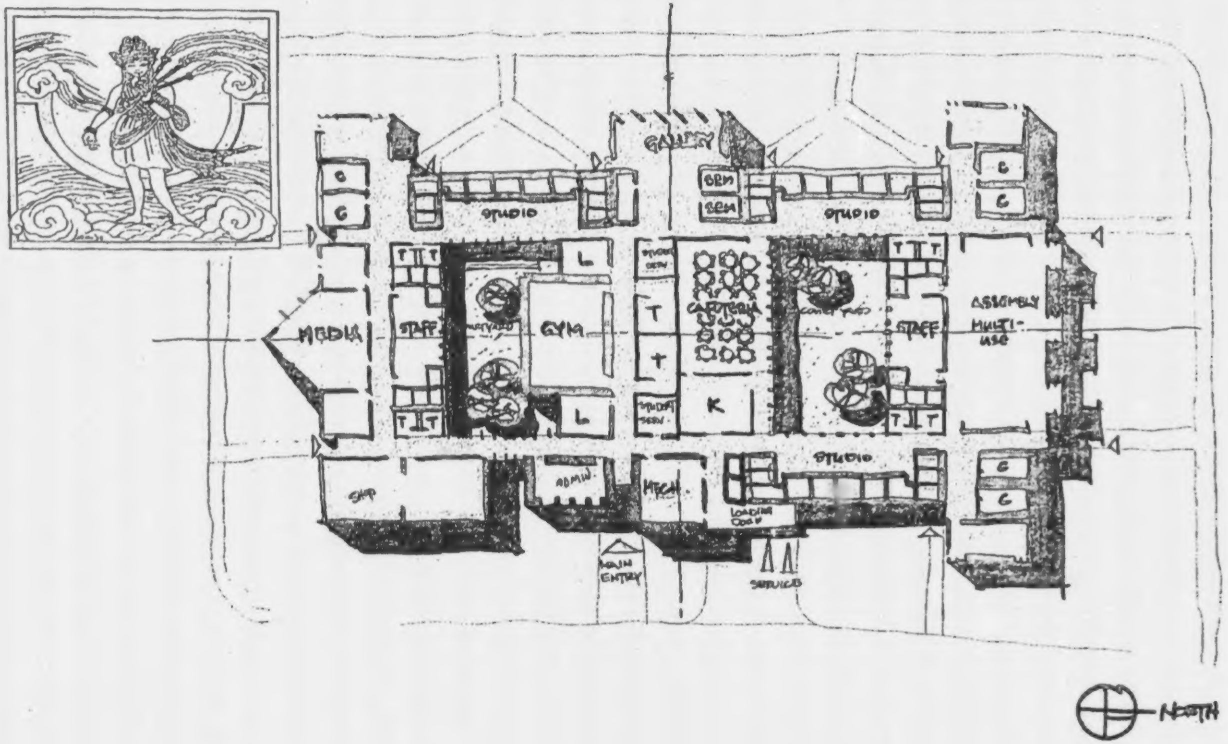
Team A designed a facility that encourages partnerships with the local community (F1,3).

> ...but it should be an enabling environment, ...we are starting to draw partnerships between the communities and business (F1,3). So, then we talked about partnership opportunities. This should be a place that has quality aesthetics to help with the pride and ownership felt by both the individuals that work here and people that use it...this should be a mark of pride for the community. It needs daylighting (F8,3), connections between the indoors and outdoors (F10,3), and options for hands on and interactive [learning] (F13,3), that tie back into [addressing] multiple learning styles. (P3F)
>
> We talked about the importance of partnerships with the community and where the partners "camp out" (F1,3) in the facility. That would be a piece of the next layer (F34,3) [referring to components of the college being built at different times as new uses became more apparent]. We developed the model from an internal standpoint [meaning the design supports the existing needs of the staff, learners, and surrounding neighborhood], and then we will work outward [determining other partnerships and needs]. Now we need to go and bring links (F10,3) toward the building [at this next stage, we need to create the external partnerships]. It is an inside/outside flipflop at this next stage [the needs of the external constituents are now the focus, rather than the internal needs]. We feel it is important to take the projects out to the public. We looked at the building as a pinwheel layout with components to create a strong link (F10,3) to the community [areas of the building are designed to "reach out" to the neighborhood (e.g. bay windows (F8,3), extensions of certain areas of the building) to create more visibility (F8,3) and access to the neighborhood (F1,3)]. (P3I)

It was Team A's intent that the "Learning Village" would retain its present purpose as a community center (F1,3) by providing access to the gymnasium (F24,3) and assembly areas (F3,3) to the greater community. "We have the four corners of the building lit up at night to serve as beacons to the community" (P3F). Team A also used the concept of "zoning" (F35,3) in their design to designate areas that ranged from private to public, from learner to staff, and according to types of activities. The zones, sometimes called "nodes" by the Team were: (a) staff node; (b) meeting zone; (c) process gallery or studio zones for messy or creative projects; (d) finished product zones; (e) courtyard zones; (f) the support zones of administration, student services, and media; (g) and the more public zones of the auditorium, cafeteria, and a gymnasium. Examples of activities in these zones were: (a) learners may access faculty planning areas by appointment rather than having open access at all times; (b) the classroom/laboratory zones were more private and used for direct instruction; and (c) as the learners gained skills, they moved their projects into the process gallery areas where the learning process became visible to other learners and staff.

In giving a verbal tour of the "Learning Village" (Figure 3), Participant P3I described the zones and nodes.

> We start with the staff node (F21,3) where the collegial work between staff and teachers occurs. It is accessible by students by appointment for tutoring. (P3I)
>
> Next we go the classroom, lab space (F36,3) [placed in three of the four corners of the building]. The classroom, lab space is a meeting zone for seminars and projects. It is more like an application lab (F13,3) where our ideas are hatched over here and then we migrate (F10,3) to multi-use [studio] spaces (F4,3) where projects are completed and then to the gallery spaces (F5,3) where they can be viewed by the public and judged for their merit. The classroom, lab spaces and the gallery spaces have lots of storage (F22,3). (P3I)
>
> To create a little more order and to create greater access, we moved the main entry to the other side of the building where it is closer to the parking. This is the area for the administration and student services. We retained the gymnasium space (F24,3), which is still accessed by the public (F1,3). We also retained the kitchen and cafeteria areas (F29,3)… We retained the courtyards [for access to the outdoors] (F10,3). (P3I)


GALLERY
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MAIN ENTRY
SERVICES
NORTH

Figure 3. Design #1.

> On the one end we kept the large assembly space (F3,3) but added more daylighting by putting in bay windows (F8,3). On the other end, we have a media space with technology (F9,3). It is a support area (F20,3) for the projects. (P3I)

After the presentation of the "Learning Village," Team A described the various zones and aspects of the design in more detail. The studio areas included: (a) space for individual work areas (F17,3), (b) team space (F16,3), (c) a larger production space for messy and creative projects (F13,3), and (d) a gallery space (F5,3). These spaces were described in the following ways:

> We created studio-production galleries (F5,3) for the finished product and the work in progress. We made the work highly transparent (F8,3) to the community from the courtyards and cafeteria so there is an interdisciplinary viewing of the stuff that is being created and worked on. We have project messy zones (F31,3) and project creative zones (F32,3). We have areas that are highly public and some that are highly private (F35,3). (P3F)

> The studio idea (F5,3) is our strongest idea of using an existing building and making the corridors go away (F28,3). It increases accessibility of student areas and integrates them with the public (F1,3) and they are open to the general population of the building. There are not a lot of secrets here. It is very open and yet has private areas (F35,3). (P3I)

> It must have a gallery show case (F5,3). A show case that can jazz up the events of things that are going on and not just the finished products but it should be a display of process of what's going on…because it is the process that counts in this whole community college. (P3F)

In addition to providing space for producing products and for showcasing final products or projects, the studio zones were seen as a way to stimulate integration of curriculum.

> The studio zones (F5,3) increase the multidisciplinary aspect of the projects. An example is the solar car project, which is next to (F20,3)

> the class studying the effects of color on the psyche, which is also next (F20,3) to the engineering studio. They all come together to create upholstery for the car. (P3F)

It was my interpretation that, not only does this space encourage Integration of curriculum, but it can also increase cognitive skills and problem-solving skills with an open space design that supports formal and informal communication and the opportunity to practice and demonstrate skills and products.

In describing the design, Team A talked about how the projects migrated (F10,3) from the classroom, lab zone (F36,3) out into the studio and gallery zones (F5,3).

> Having the projects migrate (F10,3) from space to space was to address the desire for "cross-pollination" (F10,3) within the building. There is a tendency to create a studio and the support spaces and have that work be isolated. We used galleries for the products and the production processes to be visible (F8,3) to the internal students and staff but also to the general public. (P3F)

The "Learning Village" was an example of taking an existing structure with the traditional double loaded corridor design [meaning a middle corridor with classrooms on each side of the corridor] and providing open, interactive spaces that support collaborative, project-based learning.

> We want to reiterate, to show that with all the aging community college facilities out there with the double loaded corridor plans that we can adaptably (F28,3) reuse those spaces to create group communication, small group (F14,3), [and] large group [spaces] (F15,3). We tore out the middle, the guts (F28,3) and created a more open, flexible (F4,3) space. The cost would average around $70/sq. ft. compared to $130/sq.ft. for a new building. The utility comes from using what is there and convert[ing] it to a collaborative, project-based space (F13,3). (P3F)

> It is being able to break away from the sort of sterile, stereotypical double loaded corridor classrooms down the middle to learning environments that inspire, allow for open communication and

> collaboration and sort of more in the manner in which humanity really works. (P3F)

Speaking of how humanity really works, Participant P3F, in particular, stressed the importance of being able to have easy access to food and beverage (F29,3) in a collaborative, project-based learning environment.

> Social aspects, we talked about bringing food back in. Food is a central social function to creating…a collaborative environment. When you are working with groups, I think it is important to be able to bring that [food] in. It probably goes back to our Neolithic time of sitting around the fire and waiting for the next mastodon. For collaborative, project-based learning it is important to be able to bring the food to the project or be able to take the project to food. The thought behind bringing the food to the work is to bring [encourage] discussion and to be able to continue the work around food. We are social animals. Food is a catalyst. (P3F)

Summarizing the description of the "Learning Village," Team A made the following statements:

> The definition of learning space is that there are no hard and fast rules (F4,3). It is somewhat of a random process that may occur in many different ways. In this design we tore down some walls (F28,3) to eliminate the hierarchy of teacher to student. Teachers are more roving mentors. There will be no front of the room podiums or pulpits. The teachers facilitate learning and they are also learning in this process and in this space. It is a collective environment. (P3D)
>
> Our major goals were to design with multiple scales and multiple (F4,3) destinations for learning. We designed for individual spaces (F17,3) up to the assembly areas (F3,3). The individual spaces are available for quiet work. The model may look like there are not enough traditional classrooms (F12,3), but the studio/gallery areas (F5,3) are large classroom spaces with team teaching (F21,3). The production/application labs (F13,3) are also used for teaching. (P3I)

Design # 2

Participants P3A, P3C, P3E, P3G, and P3H were members of Team B, which developed Design #2. To approach the task, Team B began by creating a picture of the community (F1,3) and identifying people the design would serve. Their team process included: (a) developing a list of characteristics of the population to be served; (b) determining the content, skills, and services needed by the population to be served; (c) identifying all the places that the learning could occur such as, community centers, local high schools, business and industry, and on campus; and (d) identifying the features of the physical learning environment that would support the learning activities and the needs of the learners.

The next planning step the Team engaged in was for each member to choose a specific collaborative, project-based learning activity. "Our team took a collaborative approach to the design process. We started with the communities and tested our ideas for appropriateness for project-based learning. We each chose a [collaborative learning] project [and] then looked for common environmental characteristics of the five projects" (P3G). The members of Team B chose the following projects: (a) developing a service learning product from which support staff of a college receive training, (b) writing a book, (c) creating a multi-media/science curriculum module to study foothills, (d) designing a musical, kinetic water sculpture in a park, and (e) analyzing a transportation system for a city.

Each project was described in more detail and included spatial and environmental needs for completing it. The service learning project given to students at a community college provided the opportunity to design training programs for college staff. The activities the learners used to develop and deliver the training programs included "assessing staff needs, assessing training modules, developing training modules, and implementing the training" according to (P3E) who then described the spatial and environmental needs for the project.

> I needed a cost-effective spatial system that is flexible (F4,3) and has access to technology (F9,3), space for communication (F13,3) storage (F22,3), presentations (F6,3), and with flexible furnishings (F7,3). I need a home base (F37,3), space for small groups (F14,3), caves [individual spaces used to work, study, reflection, or rest] (F38,3), and a production space (F13,3). A design where you can move in, occupy, and leave and not impact the next group (F4,3) using the space or needing two hours to change [the space]. (P3E)

Participant P3C described the next project as a Developmental English course taught by the Participant in which learners were asked to write a book. The learners were instructed to begin the process of writing by keeping journals and using that information as the base for the book. As explained by the Participant, "The students need quiet space to work on the journal, access to books to be used as models, a place to write the book, availability of the instructor and peers for editing and comment, and at the same time a place to receive instruction." For the project, Participant P3C described the spatial and environmental needs.

> I want a home base (F37,3), and a classroom (F12,3) where you begin the learning process. I want accessibility to computer labs (F9,3), to the commons (F3,3), to caves (F38,3), and access to the outside (F10,3). I want storage for equipment (F22,3) and I want windows (F8,3). They have to be realistic spaces. (P3C)

The third team member's project was for learners to prepare a multi-media presentation on how the foothills of a mountain range were formed as an example of an integrated curricular approach that included science, art, music, and graphic design. Participant P3A described the spatial and environmental needs to deliver the learning project.

> I need lots of windows (F8,3) that open because rooms with lots of computers generate heat and it is nice to bring fresh air into the room while keeping the room cool. I need computer spaces (F9,3) with good chairs (F7,3) because the students will be sitting in those chairs for a long time. I need science and art areas (F2,3) right next door (F20,3). It could be a messy room (F31,3) right next to the digital technical (F32,3) area. The art area needs to have moveable furniture (F7,3), especially portable tables. It is the notion of specialized spaces or studios for "dirty" (fabrication) (F31,3) projects and specialized spaces for technical projects (F32,3). I would also like to see access (F10,3) to the outdoors where there would be a walking trail, a rock garden with stones...places for students to get away to think and relax (F33,3). (P3A)

Participant P3H described her/his learning project as a musical, kinetic water sculpture for Central Park as, "An opportunity to involve the community to create something for itself. The project brings art, music, math, engineering, and dance together." Participant P3H described the spatial and environmental needs to deliver the project.

> A series of spaces (F20,3) for integrated, collaborative learning that solves math and movement problems. I need collaboration space (F39,3) for the "birth of concepts." This birth space (F40,3) needs natural light (F8,3), moveable surfaces (F7,3), space for small groups (F14,3) ranging in size from three to six up to a space for 12 to 15 people, white boards and tack walls to display concepts (F5,3), access to technology (F9,3), and access (F20,3) to nourishment (F29,3). I need a space for design work (F32,3) and another space for fabrication (F31,3). Movement of process (F10,3) needs to happen between all these spaces. (P3H)

The fifth team member's learning project was to analyze City X for the development of a transportation system. "To do the project, the students would tour the city on bicycles to gather information for field notes, go to the historical museums to do research and to do some mapping, conduct videotaped interviews, prepare graphic presentations to show the historical change and to predict future needs" (P3G). The spatial and environmental needs were described by Participant

P3G in terms of pods, studios, and a shared living room that could also be a home base. There were also adjacent studios (F20,3) for video production of interviews (F32,3); a small group discussion space that could hold up to 40 people (F14 & 15,3); a fabrication studio (F31,3) to create a clay, scale model; parking for bicycles (F41,3); and access to food (F29,3). "They need to 'own' (F23,3) this space for at least the semester, (P3G)."

> I have pods (F16,3) that serve as a home base (F37,3) for each team of four and then there is a shared living room that can also be a home base for all the teams. The shared home base has places to pin-up work (F5,3) to show during discussions and presentations and this space also serves as a lounge (F27 & 33,3). Each pod contains individual workstations (F17,3) with access to the Internet (F9,3), a "team" table (F7,3), shared secure storage (F18 & 22,3), indirect lighting and a light table (F30,3). The five pods and shared living room make up the main studio (F38,3). (P3G)

Looking across all five learning projects, Team B looked for the common spaces and activities among the projects, which were described as: (a) bringing people back together (F3 & 10,3), (b) dirty work space/loud area (F31,3), (c) access to information (F9,3), (d) home base space (F37,3), (e) access to tools and materials (F20,3), (f) caves/quiet spaces (F38,3), and (g) community interaction (F1,3) [bringing the community in to the learning environment and taking the learning out to the community]. (P3G)

Using the information from the projects and from the previous work of determining the needs of the community and those to be served, the Team developed a final design. They labeled the spaces within the physical learning environment as such: (a) home base (F37,3), which can also be used as a classroom (F12,3), (b) computer lab (F9,3), (c) caves (F38,3), (d) staff nodes (F21,3), and (e) a series of laboratory suites (F42,3). (P3G) The desirable features of each of those spaces are listed below:

1. Home Base. For the home base, which served the purposes of group instruction, discussion, and "checking in," the design features included: (a) comfortable seating and moveable desks and chairs (F7,3), (b) windows (F8 & 10,3), (c) blackboard/whiteboard (F5,3), (e) storage (F22,3), (f) freedom of movement (F10,3), and (g) close proximity (F20,3) to caves (F38,3) and computer lab (F9,3).

2. Collaboration Incubator. The collaboration incubator (F39,3) was designed for five teams (F16,3) of five learners to work collaboratively and fairly independently on their projects with the teacher or faculty member being more of a mentor or guide as the format for instruction. The team spaces had individual desks or workspaces (F17,3) for the learners, storage (F18 & 22,3), and a round table (F7,3). In addition to the team spaces, the incubator had a large, open space (F13 & 15,3) in which to work on the projects and to share with community partners (F1,3) who were involved in the project. The incubator (F39,3) was "where there can be a sense of ownership (F23,3) for a period of time. A space of my own but also a shared space (F4,3)." (P3H)

3. Computer Lab. The computer lab (F9,3) included: (a) computers set up in pods of four, (b) work surfaces [tables] (F7,3), (c) storage (F22,3), (d) printer station (F9,3), and (e) late night accessibility (F10,3).

4. Caves. The caves (F38,3) provided: (a) space for individuals (F17,3), (b) proximity to (F20,3) the home base (F37,3), and (c) [were located at] various locations and presentations [different designs of the spaces] (F20,3).

5. Staff Nodes. The staff nodes (F21,3), with access to technology (F9,3), were used for planning and communication among the faculty.

6. Series of Laboratory Suites. The series of laboratory suites (F42,3) accommodated: (a) technology labs that required high technology systems and infrastructure in a clean environment (F32,3), (b) fabrication labs for wet and messy projects that required specialized equipment and infrastructure (F31,3), and (c) combined labs (F42,3) with easy access (F10 & 20,3) to both the technology and fabrication in the same space.

> The laboratory suites were spaces that supported (F20,3) the students [while they] generated work [the project]. They began in the technology lab (F32,3) with the instructor and then the students decided when to move (F10,3) from their pods (F16,3) and into the larger incubator area (F39,3). (P3G)

> Technology laboratories (F32,3) have a natural integration of projects around a particular purpose, are authentic, and that are chosen by students. (P3A) The separate fabrication laboratories (F31,3) really get to fabrication with high systems and high infrastructure needs and then move (F10,3) the projects to different spaces (F4 & F20,3). (P3H)

The Team designed a physical learning environment that actively encouraged and supported the communities it served by making them active partners in the learning process.

> The design (Figure 4.) focused on bringing the community in and out (F1 & F10,3) of the projects in a collaborative way through the design of a "main street" (F10,3) that provided freedom of movement and access to all the spaces. (P3G) The spaces along the "main street" were a commons area (F3,3), small group/large group

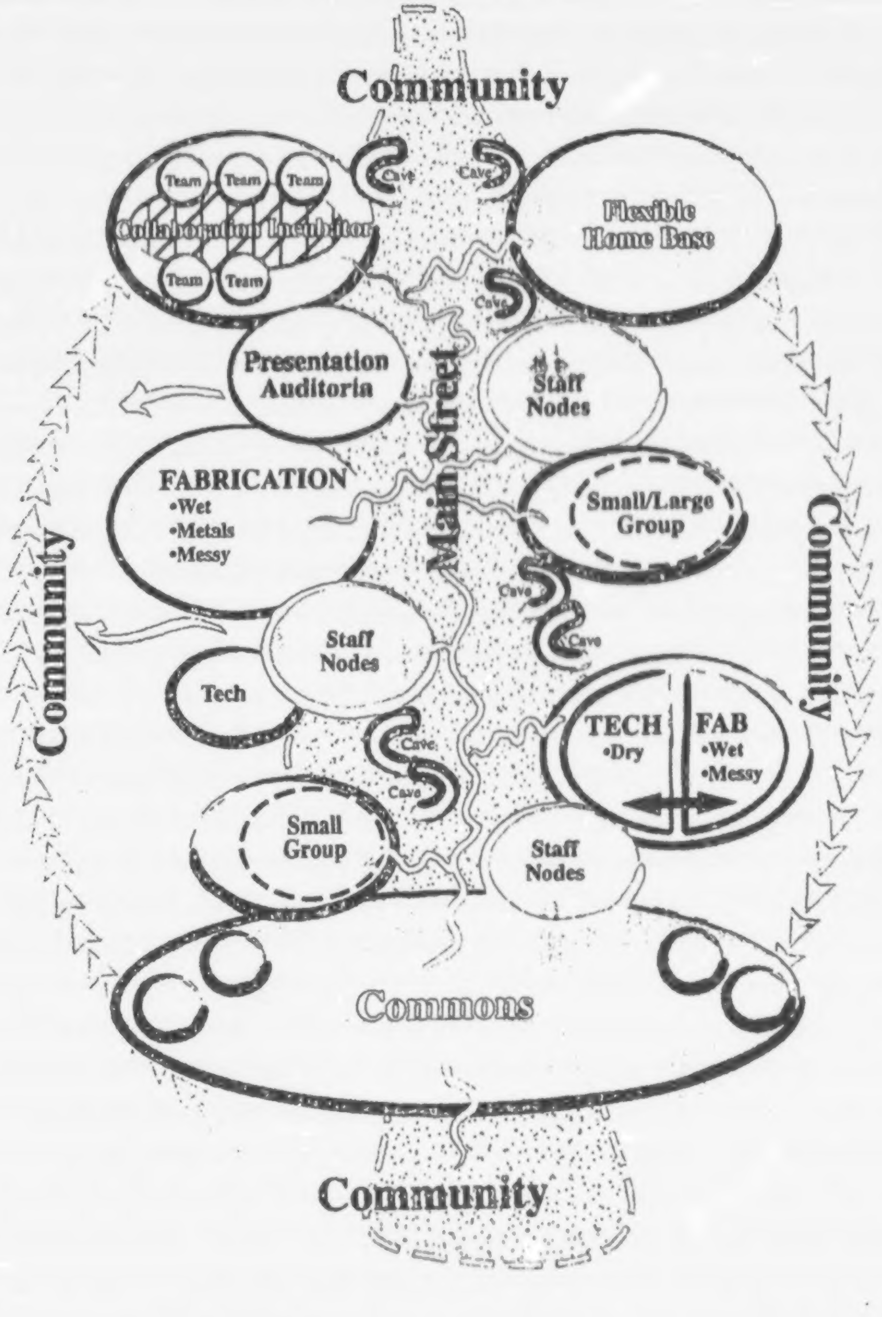
Community
Cave
Cave
Team
Team
Team
Collaboration Incubator
Team
Team
Flexible Home Base
Cave
Presentation Auditoria
Staff Nodes
Main Street
FABRICATION
•Wet
•Metals
•Messy
Small/Large Group
Community
Community
Cave
Cave
Staff Nodes
Tech
TECH
•Dry
FAB
•Wet
•Messy
Cave
Cave
Small Group
Staff Nodes
Commons
Community

Figure 4. Design # 2

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> spaces (F14 & 15,3), staff nodes F21,3), technical laboratories (F32,3), fabrication laboratories (F31,3), presentation auditoria (F6,3), caves (F38,3), a flexible home base (F4 & 37,3), and a collaboration incubator (F39,3). (P3C)

In recognizing the need to prepare the learners to work collaboratively in teams, Participant P3E described the flow of learning (F10,3) activities in collaborative, project-based processes.

> You can't drop a student into a 100 percent collaborative effort. They start in the home base (F37,3) and set group goals. Once their skill base increases in working collaboratively and they are ready for more complex work, then they can move (F10,3) into the incubator (F39,3). The incubator has flexible walls (F4,3) and students define their own spaces. (P3E)
>
> We are not talking about all of this for all of the students. It does provide territory for a space of time and can be easily adapted (F4,3) [for the purposes of the study I would interpret this to mean flexible]. There can be music, science, and art in one area [pod] (F16,4) or business partnerships in another area (F1 & 16,3). It needs to be very adaptable [flexible] (F4,3) and provide for the student to community, community to business, and business to student linkages (F10,3). (P3H)
>
> The idea of a collaboration incubator (F39,3) is new territory for community colleges. The incubator is used with community partners (F1,3). When balanced with a home base (F37,3), it is more the norm of today (P3G). For community college students, it is important to create connections and linkages (F10,3). It is easy to lose the magic of belonging (F23,3). (P3H)

Design # 3

To explain the reasoning for wanting to create a separate design from Team A, where Participant P3B was originally assigned, he/she began the presentation of the third design by saying, "I felt myself becoming five or six people. Part of us stayed with the team, and I respect what they are doing because I was part of it, but other parts of me wanted to be heard." Participant P3B's design was presented as a story through words and a series of illustrations and diagrams with the story focused more on general design principles that could be applied to physical environments that support and enhance collaborative, project-based learning. It was my interpretation that Participant P3B wanted to challenge the thinking of all the participants at the design studio and the purpose of the study, and not restrict the thinking of design to being constructed from limited views. The presentation provided a historical look at how architects, educators, and communities have been designing educational facilities based on societal history rather than being based on present or future societal needs.

The story, presented by Participant P3B, began with a diagram (see Figure 5) providing guidelines to four layers (F34,3) of what needs to be designed and not be designed for the physical learning environment. One point made was that the layers illustrated the need "to think in terms of the design being done incrementally, and the layers being integral (F20,3) to one another and providing a sense of coherency (F43,3) to the learning" (P3B). Participant P3B's thinking was in part based on the thinking of Leon Battista Alberti (Chaoy, 1997). "For Alberti, more than any other activity, building evinces the creative powers of men [sic] because it is superior to other activities in satisfying demands on the three levels on which human activity functions, those of necessity, commodity, and aesthetic pleasure…a building consists of form determined by the mind and matter determined by nature" (Choay, 1997, pp. 67-69). The following was Participant's P3B's explanation of Figure 5.

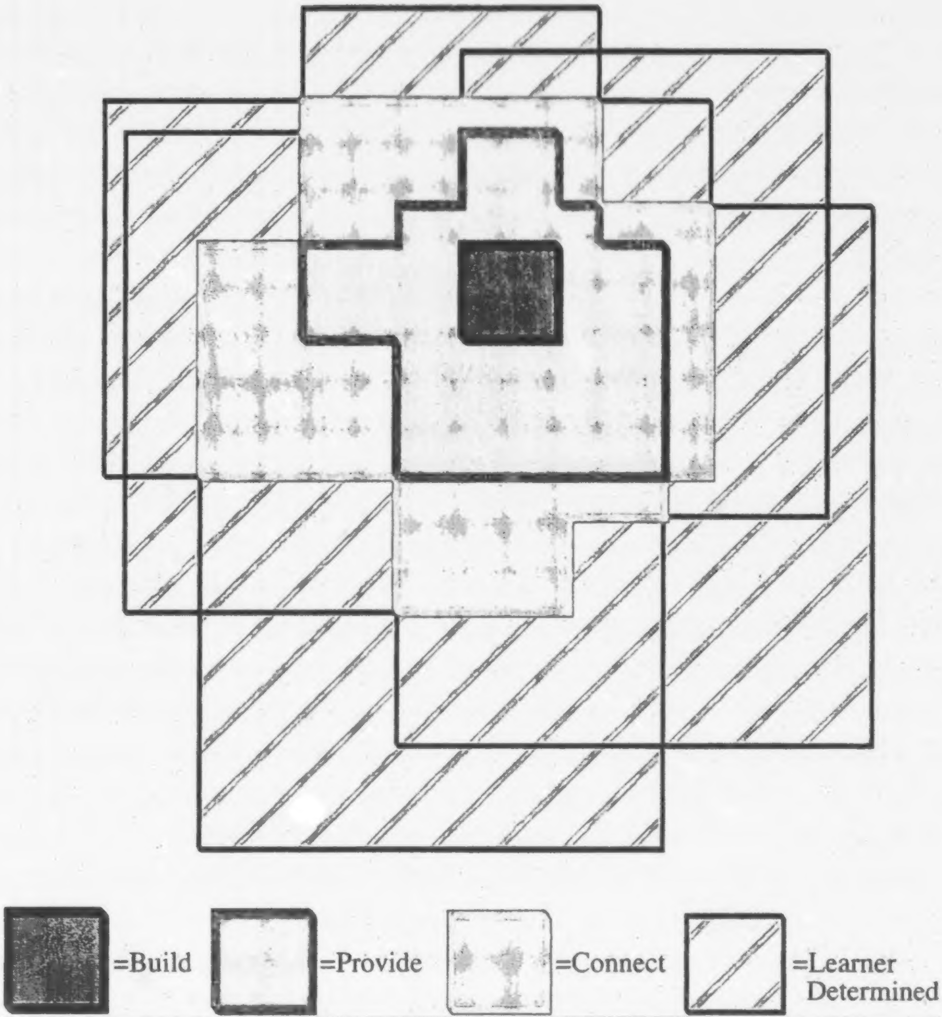

Figure 5. Design #3.

> We [in reference to the notion of Participant P3B becoming five or six people and as a means of illustrating a design process involving several people with different philosophies and concepts of school design] started with colors representing the different points of view. One area [of the design] where we overlapped (F34,3) that we all agreed upon was the red box. There was enough agreement and enough money to build the bricks and mortar that supported a learning process. An area that some of us agreed upon, but didn't want to build, but did want to at least provide for (F1,3), was illustrated by the green box. The brown area indicated the area that

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> we did not have money for but we wanted to see that the connections (F10,3) were [made] so that the learners could get to it. And finally, the rest of this [Figure 4], the cross-hatched areas, we thought of in terms of creating a learning environment that had to be done [designed] by the learners themselves (F4,3). That was how they [the five or six people] showed their uniqueness. (P3B)

My interpretation of this quote was that when designing a physical learning environment, it is not always necessary to include spaces or features in the school or college that can be accessed through other means such as community partners, as was illustrated in Phase I with the School of Environmental Studies and the Interdistrict Downtown School. Participant P3B also emphasized, throughout the Studio, that learners need to be given more responsibility in designing their own learning and to determine what is needed in terms of features of the physical learning environment that support and enhance that learning. The significance of that responsibility was shown in the layers (F34,3) to illustrate the desire to design what Participant P3B termed as the armature (F44,3) or basic framework of the physical environment. Participant P3B described the armature with these words:

> The armature creates a richness or soul of the building and a creative transformation of the building (F28,3). The richness comes from what the learner does with the environment (F4,3). We should allow them to do that more by collecting the insights, desires, and intents [of the learners]. (P3B)

From my perspective, Participant P3B was suggesting that by designing only the basic framework and infrastructure of the building and leaving the rest undone allows for different learners to more easily transform (F4,3) the use the space in a manner that is conducive to their learning.

To create a context for the purpose of Figure 5, Participant P3B displayed several other illustrations he/she created to describe a fictional city. In this city, the public [educators, city, architects, and funding agencies] designed and built a large school away from residential neighborhoods because the only property that was affordable was in the industrial part of the city. In contrast to the just mentioned scenario, Participant P3B explained that at the same time a private developer hired an architect to design several other public buildings in the city including a bank, a library, a hotel, and a church, which were all located within the neighborhoods. The story began in the year 2000 and ended with the year 2020.

> The year was 2000.
>
> The next picture is to take a very real, virtual city and tell a story. The city was built about 150 years ago along two rivers. Freeways were added to give more structure. Community icons were built in 2000. Those icons were a library, hotel, bank, and church built in the residential neighborhoods (F1,3) by a private developer and a school built by the city [dollars]. The school was built in the industrial area (F1,3) next to the river because it was the only area that the city could afford. (P3B)

In my view, the first part of the story illustrated the development of the infrastructure of a city and contrasted two views of how to plan for and where to locate public facilities.

> It was now the year 2010.
>
> There were changes. The people realized they didn't need as much industrial land [and] they took out some of the freeways because people couldn't afford cars anymore because of the high fuel costs, so some of the freeway space was turned into green space (F28,3). The hotel went out of business because people were not traveling as much. The bank went out of business because everything was done electronically, so they didn't need a building anymore. (P3B)

From my opinion, the above, second part of the story from the year 2010, portrayed how cities and their infrastructure transform as societal and economic changes occur.

> It was now the year 2020.
>
> The trend had continued. The library had been replaced with everything being available electronically and the church has gone out of business because...I won't talk about that for many reasons. The school building also went out of business and was taken over by industry because it was the best building for them to use. It made more sense to use the school [because of its original design] than some of the other [available] infrastructure. At this time, smaller sites of learning were beginning to appear throughout the community. The former library, bank, hotel, and church became school sites (F28,3)[dispersed throughout the city] (F20,3). (P3B)
>
> The design of the original school built in the year 2000 had an area that I call the "jaws" where the administrative offices were—with a nice view of the river. The next part was the classrooms or the "cells." The back of the animal..."I'm trying to use soft language here" was for the leftover programs such as vocational education. Our built environment gives messages to people. We call this a citadel. The signature for the building is the school bell, which is how they orchestrated all activities. (P3B)

Again, from my perspective, in the two paragraphs of the story from 2020 Participant P3B explained that the changing societal and economic trends continued affecting the use of the remaining public buildings or icons that had been built in the year 2000. The school building, being located away from the residential neighborhoods and with its design being modeled from an industrial era point of view, easily became an industry facility (F28,3). Participant P3B's further description of the school presented a facility that supported learning that was highly structured around static time frames and where the learning activities were segregated from one another and from the other personnel and activities in the building.

The other part of the story from the year 2020 is that the other public icons [buildings] built by the private developer had now become neighborhood schools

(F28,3). The architect and developer had designed the armature or basic framework (F44,3) of these buildings to be easily transformed (F28,3) for other uses. Each of the buildings had entrance areas to greet the user, activity spaces, service areas, and spaces that supported the activities of the other areas.

The purpose of the story was to illustrate two different design processes used for the built [physical] environment and the resulting messages that the built environment gives its users. In an effort to explain the two different processes, Participant P3B explained that the process used to design the school was based on using a model. In this case, the model was based on late 19th and early 20th Centuries learning theories that prepared learners to work in a factory or industrial setting where uniformity was desired. The design process used for the built environment of the other public buildings was based on rules that integrate site conditions and location, user needs, and aesthetics.

In explaining the differences of the two design processes, Participant P3B again referred to Choay's (1997) work, explaining models and rules. Choay compared the ideologies of architecture and design from the juxtaposition of Thomas More's Utopian thinking using models and Leon Battista Alberti treatise of the set of rules and principles of the built domain. "Raphael Hythloday [another Utopian thinker] began by pointing to the standardization [model] of the built environment, urban and rural…fifty-four cities built according to the same plan, identical in appearance" (p. 140), and "Alberti specified that to provide aesthetic pleasure, the built environment must obey a set of fixed rules relating to the actual condition of the site, the demands of the users, and their aesthetic sensibility" (p. 279).

My understanding of how Participant P3B used Chaoy's work is that built environments designed from models tend to be identically replicated at different sites and based on assumptions of use that have been perpetuated throughout time rather than from current or future context. The school in the above story illustrated this interpretation. To contrast how design, based on rules, allows for a built environment that can be used for multiple uses (F28,3) and dependent upon the needs of users, Participant P3B described the rest of the illustrations of how the private developer designed the bank, church, hotel, and library.

> The enlightened, private developer designed [built environments using rules rather than models] because he knew what was coming [societal and economic change]. The bank had a common space (F3,3) in which to access the services. The church had the spaces of the narthex [public entry and gathering place] (F3,3) and the nave [central activity area] (F13,3) with side spaces (F20,3). The hotel had a common shared space (F3,3), dining space (F29,3), gift shop, bar, lobby, and guest rooms, bathrooms, and storage (F22,3) on the upper floors. The library had a reception area (F3,3), a place for periodicals, magazines, stacks, (F9,3) offices, toilets, conference rooms, seminar rooms (F14,3), and a space for special collections (F9,3). (P3B)

It was my interpretation that by creating the armature (F44,3) for the design based on human need or following the rules rather than a model, that the bank, church, hotel, and library all supported the user in whatever activity was chosen at the time (F28,3). The citadel school was based on the factory model of earlier schools (illustrated by Tapaninen's remarks in Case Study 1 in Chapter 5) designed to support the functions of the industrial era, rather than support human need. A current example of a learning institution built from rules rather than a model and one that supports and enhances collaborative, project-based learning, Participant P3B, described the physical learning environment of the Heinavaara Elementary School in Finland.

> Schools [using collaborative, project-based learning processes] need the following types of spaces: shared resource areas (F20,3), socialization areas (F3, 27, & 37,3), large group spaces (F15,3), small group spaces (F14,3), seminar spaces (F14,3), and individual workspaces (F17,3). (P3B)
>
> The curriculum [in Finland] had shifted from the national, textbook approach to project-based learning. The components [of the space] are a home base (F37,3), which is part of the central resource space (F20,3). You have overlapping spaces (F34,3). The central resource area, the furnishings (F7,3), and artifacts provide the technology (F9,3), the access (F10,3), the resources, the books, paper, and pencils (F22,3). There was space on the floor. Kids like to work the most on the floor (F4,3). There was group directed and individual work. (P3B)

The learning expectations, processes, and physical learning environment described above are at the K-12 level; however as was stated in earlier chapters, many of the current learning facilities that are designed in ways to support active learning processes, such as collaborative, project-based learning are K-12 facilities. Also, stated earlier in a quote from a community college vice president, for community colleges to remain as leaders in preparing adults for the changing roles and responsibilities for work, family, and community life, the colleges must now reinvent themselves and look to future need rather than past practices. K-12 learning practices and facilities can be viewed as precursors to what community colleges need to be paying attention. A larger percentage of high school graduates are now first attending community colleges before continuing postsecondary education and come with anticipation for different learning expectations, processes, and environment based on their K-12 experiences.

Expanding on the premise of designing the armature (F44,3) or basic framework of the built environment, and of using rules rather than models to design physical learning environments for collaborative, project-based learning, Participant P3B next presented what he/she termed as injunctions [rules] for designing the physical environment. The injunctions [using her/his labels] are: (a) support vision, (b) support communities, (c) support sapientential [wisdom], (d) [support] fine grain, (e) support built technology, (f) support nested spaces, and (g) support physical [or built environment]. The following descriptions of these injunctions, in the Participant's own words, are followed by my interpretation [in brackets].

1. Support Vision

> Move from a vision of seeing the earth flat [or only seeing our own "piece of the world"] to a vision place where we can see the big picture, [where] we can comprehend it as a whole. We need to have the long view. So often our decisions are based on the short view. (P3B) [Decisions regarding curriculum, how best to serve learners, and the design of the facilities to support learning should be based on future vision, not current or past practice].

2. Support Communities of the Mind

> Science tells us that we started out as rocks, then cells...small creatures, then animals, then men and women, to global minds working together through technology (F9,3). (P3B) [Humans have evolved from one-celled creatures to an organism with a well-developed mind that for the majority of people is not used to its fullest potential. Technology assists our mental processes. An example is how technology has brought a global perspective to all aspects of life and provides the opportunity to create vision and solutions using the richness of diversity].

3. Support Sapientential

The mind and body are all together, not separate. The mind is the body, the mind and the brain stem together. We need scaffolding to learn with all our cells not just our brains. We need to recognize that as people develop we [they] need scaffolding to deal and interact with our world. Without the scaffolding, we would be mindless. To complete the framework (F44,3) [scaffolding], we need to learn and we need angels to help us out [and] to make us viable individuals. (P3B) [Wisdom or discernment comes from learning through experience and application as well as through cognitive learning processes. Collaborative, project-based learning uses a whole body approach to learning by incorporating relevancy, experience, and application to cognitive learning. Learning and living experiences are enhanced when others, our Angels, guide and support us. Angels may be in the form of human beings or other living creatures].

4. Fine Grain

In the coarse grain world, we learn, live, and work in separate areas. Europe is more medium grain where learning, living, playing, and working are more integrated. We need to move to a fine grain community (F1,3) where we learn, live, work, and play within close proximity (F20,3) to one another so they are sustainable. This is a real doable community. When I speak of communities in the U.S., I use the term lightly and that is one hell of a stretch of the word.

A good example of the physical support, in a fine grain way, are the canal houses in Amsterdam, built in the 17th century. What is behind the façade? Take six of those houses and you have a hotel, two you have a shop, and three you have a school. It is the rhythmic, organized structure that serves the community behind the facades. They are variable (F28,3) as the needs change. They are based on the human scale and we as humans haven't changed much over the 100,000 of years we have existed. (P3B) [Learning occurs in all aspects of life, not just in formal learning settings. Integrating learning with life and having learning take place in community settings increases sense of community and brings relevancy to learning. The built environment should be designed to adapt to new uses].

5. Support Built Technology

Engagement in learning is higher when we increase coherency (F43,3) and access (F10,3). I call this built technology because the building and technology (F9,3) are working together. The role of the

> built environment is to increase coherency. (P3B) [Design the learning so it becomes a coherent whole rather than separate subjects and design the built environment to support that coherency and integration of learning expectations and processes. Incorporate and increase access to technology and other resources to enhance the learning].
>
> 6. Support Nested Spaces
>
> We need to support nested spaces (F20,3) of learning. It is the relationship of spaces, spaces that overlap (F34,3) that creates the pulsating juxtaposition. It has nothing to do with corridors or other disconnected elements. We need the coherence (F43,3) and the connections (F10,3) with access to the various spaces. As Alexander (1979) talks about in his book, design is all about relationships. It is the relationship of the street to the front door, to the building. Our communities are more sustainable if we build at the relationship level. (P3B) [Adjacent learning spaces that invite and encourage others to enter and participate encourage the building of relationships that sustain learning and living].
>
> 7. Support Physical [Built Environment]
>
> We create very few basic frames or elements. The rest is filled in by the user (F28,2). That approach works for schools, hotels, churches, and banks. Build the infrastructure and let those who learn, live, work, and play there fill in the rest. Project-based, collaborative learning needs micro spaces (F4,3). (P3B) [Participant P3B advocated for the basic framework and infrastructures being designed and having the user of the built environment decide what design features are needed to support the activities occurring in the space. In the case of designing the built environment for learning, the staff and the learners should be involved in the design process].

Summary

The two-day design studio was a productive venue for building relationships among participants who are actively involved in designing physical learning environments and who plan and implement, and learn from collaborative, project-based learning. Phases I and II were designed to collect data from observation, participation, notes, personal audio and electronic mail interviews, and reflection. The data collection methods used in Phase III included observation, my notes, individual audio recorded interviews, participants' personal journals, audio recording of selected group discussions, text and design materials produced by the participants, video recording of final presentations of the three designs created by the participants, and reflection.

I asked that the participants of Phase III specifically focus on collaborative, project-based learning at the community college level. One participant did use an elementary and high school as examples of learning environments due to lack of community college sites using collaborative, project-based learning. Allowing for flexibility in the studio agenda and activities placed us all in a typical collaborative, project-based learning environment. The teamwork and group discussions provided insight into what resources were needed and what design features of the physical environment supported and enhanced participant work or created a hindrance.

Analysis of Phase III

Analysis of the data shown in Table 4 used the same basic format and labeling as was used in Phases I and II in Tables 2 and 3. To continue to illustrate the emerging patterns of features, Table 4 included the analysis of findings across all three phases of the study. The analysis of Phases I and II were shown in italicized typeface with the analysis of Phase III appearing in regular typeface. Thirty-three features had been identified at the end of Phases I and II and many of these features were also mentioned by the participants of Phase III. All features remained in the table independent of which phase(s) they were described. New features emerging in Phase III are numbered 34 to 44.

Table 4

Design Features and Related Rationale of the Physical Environment that Support and Enhance Collaborative, Project-based Learning at the Community College Level from Phases 1, II, and III.

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	***Phase II # Times Listed***	**Phase III # Times Listed**	**Total # of Times Listed**
F1,1	*Access to community*	*Use of community, business, and other institutions of learning for space, curriculum, materials, personnel, and funding.*	*Brings relevancy to curriculum and learning. Builds active partnerships between agencies.*	6			
F1,2		*Broad network of people and settings providing learning opportunities.*	*Creates learning system that extends beyond the classroom. Reduces need to build certain components of the physical learning environment by accessing available community resources.*		*4*		
F1,3			Integrates community into learning activities onsite and taking learning out to the community.			18	
	Community center	General purpose space such as gymnasium or auditorium.	Offers use of facilities to community.				28

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	***Phase II # Times Listed***	**Phase III # Times Listed**	**Total # of Times Listed**
F2,1	*Learning laboratories*	*Indoor or outdoor areas for learning science, technology, dance, music, and art projects.*	*Provides space and infrastructure to accommodate specialized equipment for learning activities, develop and practice specialized skills, bring relevancy to the learning process, and provide security of the equipment.*	*6*			
F2,2			*Provides learning space for experimentation.*		*5*		
F2,3						2	13
F3,1	*Large, open space*	*Commons, cafeteria, plaza, "town square," auditorium, presentation, and gathering space.*	*Provides for multiple uses of the space and the ability to gather large numbers of people together.*	*2*			
F3,2	*Center*	*Central space for learning.*	*Provides openness in the physical learning environment.*		*7*		
F3,3	Assembly area, gathering place, reception area		Provides large, open space for community use and to bring people together for socializing.			11	20

Table 4, Continued

Code	**Title of the Feature**	**Description of the Feature**	**Purpose of the Feature**	*Phase I # Times Listed*	***Phase II # Times Listed***	**Phase III # Times Listed**	**Total # of Times Listed**
F4,1	*Flexible spaces*	*Spaces change easily and quickly for new uses or in which several activities can occur at the same time. Can be changed moment to moment and day to day to respond to changing activities (e.g., folding walls, track lighting, moveable furniture and casements, multiple technologies).*	*Encourages and supports integration of courses and programs through the sharing of space and equipment.*	*7*			
F4,2		*Floor spaces for work or sitting.*	*Increases work surface space and expands boundaries within the same space.*		*10*		
		Moveable walls and cabinetry.	*Provides maximum use of space for multiple purposes and different sized groups.*				
F4,3	Multi-use spaces	Varied scales of space and destinations for learning.	Supports "no hard and fast rules" for use. Users design space.			17	
	Semi-fixed elements		Provides for flexible use and transforms quickly with no impact on the next user.				

Table 4, Continued

Code	**Title of the Feature**	**Description of the Feature**	**Purpose of the Feature**	*Phase I # Times Listed*	***Phase II # Times Listed***	**Phase III # Times Listed**	**Total # of Times Listed**
F5,1	*Public display space*	*Tack boards or surfaces, display cases or wall space, galleries, and studios.*	*Provides places and spaces to display work, pictures, and awards to the public.*	*4*			
F5,2					*0*		
F5,3	Production galleries		Shows work in progress and displays process not just finished product. Learning space as well as a display space.			11	
	Studio zones		Encourages integration of curriculum.				
	Display surfaces	White boards/blackboards/pin-up areas.	Shows and shares ideas and work during discussions.				15
F6,1	*Presentation space*	*Auditoriums and stages.*	*Space in which skills and knowledge are presented and demonstrated.*	*3*			
F6,2					*1*		
F6,3	Presentation auditoria					2	6

Table 4, Continued

Code	**Title of the Feature**	**Description of the Feature**	**Purpose of the Feature**	***Phase I # Times Listed***	***Phase II # Times Listed***	**Phase III # Times Listed**	**Total # of Times Listed**
F7,1	*Moveable, flexible furniture*	*Furniture that can be moved, stacked, and reconfigured easily.*	*Provides versatility in how space can be used to support the learners and the learning activities.*	*1*			
F7,2	*Comfortable, versatile furniture*		*Provides comfortable and moveable seating for the longer time frames of project-based learning and for flexible use.*		*7*		
	Flexible technology arrangements	*Technology that can be moved and reconfigured easily.*	*Supports project-based learning model that requires flexibility in use of space.*				
F7,3	Flexible furnishings	Moveable surfaces.	Provides for multiple use through the shapes of the surfaces.			9	17

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F8,1	*Interior/ exterior windows*	*Outside windows, glassed garage doors, and window walls.*	*Provides natural light, visibility into the learning areas as well as visibility to the outside, and provides acoustical control.*	*6*			
F8,2			*Provides visibility of the learning process.*		*3*		
F8,3			Provides access of the learning to the community and brings the community inside. Makes the work highly transparent. Provides fresh air.			10	
		Daylighting	Provides natural lighting.				19

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F9,1	*Technology*	*Telephone, facsimile machine, copier, TV/VCR, computer, printer, scanner, electrical and electronic tools, and specialized equipment.*	*Provides tools to locate information; produce information, products, and services; and gain skills.*	*9*			
F9,2	*Laptop teaching station*	*Teaching station with access to wiring to plug in laptop computer.*	*Increases flexibility of the faculty member to deliver instruction in different spaces.*		*11*		
	Library/media resource center	*Information resource area.*	*Provides access to print materials and equipment to receive and deliver instruction.*				
	Net-surfing and media bar	*Informal computer resource area.*	*Provides wired and wireless technology for flexibility and convenience for accessing information.*				
F9,3			Provides ability to use global resources.			17	
			Supports the use of the built environment.				37

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F10,1	*Connections*	*Links and circulation patterns among interior spaces and between interior and exterior spaces.*	*Links activities, learners, staff, and the external community as they move from one activity to another. Provides visual connection between spaces.*	*4*			
F10,2			*Provides connection with others. Encourages integration of activities. Provides dynamic links between learning sites throughout the geographic area.*		*7*		
	Streets, paths	*Pathways with learning areas on each side.*	*Provides access to the learning activities.*				
	Dutch doors	*Door in which the top half opens allowing the bottom half to remain closed.*	*Provides separation and connection.*				
F10,3	Links		Provides connections between indoors and outdoors and between the building and the community.			27	

F10 (cont).	Access		Supports movement of projects and processes from one space to another as needed and cross-pollination [integration] of ideas and projects. Brings people back together. Offers freedom of movement and flow of learning. Provides accessibility for use beyond traditional hours of operation. Supports partnerships with the community. Provides access to resources.				38

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F11,1	*"House" concept*	*A way to organize learners into "smaller" groups that stay together for a period of time up to a year.*	*Provides sense of small school and a learning experience focused on individual or team interests and experiences.*	2			
F11,2	*"Study House"*	*A way to organize secondary education level in The Netherlands using clusters of subjects using an integrated approach.*	*Promotes individual learning plans using project-based learning. Learning takes place independently or in small groups. Teachers are coaches. Academic and vocational programs are organized this way. Develops critical thinking, brings relevancy to the learning, and teaches responsibility for one's own learning.*		*1*		
F11,3						0	3

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F12,1	*Space for group instruction*	*Room that is designed and furnished to support direct instruction to a group of learners.*	*Provides space to teach topics, skills, or concepts to a group of learners.*	*4*			
F12,2					*1*		
F12,3			Provides space to begin the learning process.			3	8
F13,1	*Project space*	*Space that provides a variety of sizes and shapes of flat surfaces (e.g., tables, benches, floor space) cabinets for supplies and small hand tools, sinks, storage for projects, access to technology (in the same space or adjacent space), and task lighting.*	*Provides space to produce information, products, and services; to practice acquired skills; and duplicates the work environment.*	*4*			
F13,2					*3*		
F13,3			Provides space for hands-on, application, production, and interactive learning. Provides space for messy, creative, and collaborative projects. Encourages communication. Provides central activity area.			9	16

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F14,1	*Small group space*	*Space to accommodate groups of learners ranging in size from 3-15.*	*Used for group study sessions, team meetings, discussions with teachers/faculty, or seminars.*	*3*			
F14,2			*Interspersed throughout the building for use by individuals and small groups for project work.*		*5*		
F14,3						8	16
F15,1	*Large group space*	*Space to accommodate groups of learners ranging in size from 15-40.*	*Used for multiple purposes for larger groups of learners who are working on projects or similar activities.*	*1*			
F15,2					*1*		
F15,3						5	7

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F16,1	*Team spaces or "pods"*	*A space that accommodates a team of 5-10 learners. The space includes individual desk space, secure storage for personal belongings, team table, work space, and access to technology.*	*Provides personalized work areas for individuals or teams that is "owned" for a time period.*	2			
F16,2			*Provides space for teams to meet and establish learning activities.*		*3*		
F16,3						6	11
F17,1	*Individual study, work, or reflection space*	*Individual learner desk, work station, or workspace.*	*Provides an individual work surface with a display area to personalize the space, secure storage for personal belongings, access to technology, and may or may not be located within a team space or "pod." Provides a quiet space for study, work, and a sense of one's own space.*	2			
F17,2					6		
F17,3						6	14

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F18,1	*Lockable personal storage*	*Secure space within one's own work or study area.*	*Space to secure personal supplies and belongings.*	*1*			
F18,2					*0*		
F18,3						2	3
F19,1	*Personal display space*	*Tack board or display surface.*	*Surface to display items to personalize work or study space.*	*1*			
F19,2					*0*		
F19,3						0	1

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F20.1	*Adjacent spaces*	*Spaces in proximity of one another.*	*Supports development of relationships among learners, faculty, staff, community;; and encourages integration of learning subjects and processes.*	5			
F20.2			*Provides close proximity of faculty with learners plus use of shared space.*		6		
F20.3		Series of spaces.	Provides access to technology, fabrication tools, materials, and spaces within the same general area. Spaces that are integral to one another and dispersed throughout the site. Provides a central resource area for all other spaces.			20	31

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F21.1	*Teaching team space*	*Office suites or teaching team rooms.*	*Space used for planning and preparation of curriculum and materials. In some cases designed to provide direct access of faculty to learners and learning experiences.*	*4*			
F21.2			*Provides space for "coaching" learners and their activities. Provides protected space for preparation of learning materials.*		2		
F21.3	Staff node or zone		Supplies technology and access to resources for faculty.			6	12
F22.1	*Supply/ Storage space*	*Space to house large sized or cumbersome supplies or a large inventory of supplies needed for projects.*	*Provides ready access to materials for the learning activities.*	*4*			
F22.2					2		
F22.3			Provides storage for resources and equipment.			9	15

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F23,1	*Sense of pride and ownership*	*A space in which users feel "at home," use responsibility, and invite others to the space.*	*Reduces vandalism, theft, and excess wear of the space and features.*	*1*			
F23,2			*Provides learners a sense of "home." The learners identify themselves with the building. Humans have a need for identity and to not feel anonymous or disconnected.*		*4*		
F23,3			Provides a space "to own" for a period of time and provides a sense of "belonging."			3	8
F24,1	*Practice space*	*Gymnasiums and YMCA.*	*Space to practice skills such as physical fitness, sports, and dance.*	2			
F24,2					*1*		
F24,3						2	5

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F25,1	*Durability*	*Building material and finishes that withstand heavy, messy use.*	*Allows spaces to be used for planned activities with less concern about damage to surfaces such as floors.*	*1*			
F25,2					*0*		
F25,3						0	1
F26,1	*Building as a learning tool*	*Visible infrastructure and mechanical systems.*	*Provides hands-on learning in maintaining systems and relevancy to course work.*	*1*			
F26,2		*Signage and graphical images.*	*Used to teach subject matter such as science and foreign language.*		*1*		
F26,3						0	2

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F27,1	*Informal learning spaces*	*Non-classroom spaces where learning takes place (e.g., hallways, commons, and study spaces).*	*Provides small study and informal gathering/conference spaces for socializing and informal learning.*	*1*			
F27,2	*Edges*	*Places outside of formal learning spaces where interactions take place.*	*Provides serendipitous interactions that can lead to creativity and innovation. Supports the formal learning processes.*		*7*		
	Gazebos		*Provides social places just for the learners.*				
F27,3	Lounge		Provides areas for socialization.			2	10

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F28,1	*Adaptability*	*Alteration or change in form or structure to fit new use. Larger infrastructure and space changes that take more effort and time than moment to moment and day to day changes, but are less costly and take less time than major renovations (e.g., de-mountable walls).*	*Ability to make space suitable for future use by means of change or modifications.*	*1*			
F28,2			*Adapts as the program changes and becomes more defined or a different program is added to the curriculum.*		*1*		
F28,3			Shows the evolution and transformation of the spaces such as removing existing corridors and walls to create open, usable spaces.			16	
			Shows the reuse of buildings, other infrastructure, and spaces for new purposes.				18

Table 4, Continued

Code	**Title of the Feature**	**Description of the Feature**	**Purpose of the Feature**	***Phase I # Times Listed***	***Phase II # Times Listed***	**Phase III # Times Listed**	**Total # of Times Listed**
F29,2	*Access to food and beverage*	*Cafeteria, commons, cafes, vending machines or access to a microwave.*	*Supports project-based learning by providing access to food and beverages at convenient times. Also, duplicates what is found in the work and living environment.*	*0*	*6*		11
F29,3		Kitchen	Provides ready access to food and beverages.			5	
		Dining space	Supports importance of having easy access to food and beverages for collaborative, project-based learning processes as a means to socialize and promote informal learning.				
F30,2	*Lighting*	*Task, track, and general lighting of the interior physical spaces.*	*Provides specific type of lighting to support and enhance learning tasks and to create ambience in certain areas.*	*0*	*2*		3
F30,3		Indirect lighting, light tables,				1	

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F31,2	*High-bay, shop spaces*	*Shop areas that are often termed "messy or dirty."*	*Provides learning spaces with high ceilings to accommodate specialized equipment and mechanisms for moving heavy or large pieces of equipment.*	*0*	*1*		
F31,3	Project messy zones		Provides spaces for loud, wet, messy, and dirty projects.			9	
	Fabrication spaces, studios, or laboratories		Provides high infrastructure and high technology systems for projects.				10
F32,2	*Clean room spaces*	*High,technology spaces*	*Provides space for high technology equipment and "clean" processes that require specialized infrastructure and low levels or zero contamination.*	*0*	*1*		
F32,3	Project creative zones	Digital technical area	Provides specialized areas for design work, technical projects.			9	
	Technology laboratory						10

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F33,2	*"Slump" spaces*	*Think-tanks and "get-away" spaces*	*Provides a place to generate synergy, new ideas, rest, and reflection.*	*0*	*1*		
F33,3			Provides a place to relax.			2	3
F34,3	Layers	Increments in developing the built [physical] environment.	Creates options and guidelines for what to build and when to build.	*0*	*0*	6	6
	Nested spaces	Components to a design or use of a building.	Provides a physical environment in which components can overlap one another in use and purpose. Creates a "pulsating juxtaposition" [dynamic flow of ideas and work] of activities.				
F35,3	Zoning	Areas designed for specific use and may be designated as public or private.	Supports stipulated activities in certain spaces, from private to public, or by designated people. Provides identification to spaces.	*0*	*0*	3	3
F36,3	Classroom/ laboratory	Space with more general classroom setting and for teamwork use in developing goals for project.	Provides meeting space for seminars and projects.	*0*	*0*	2	2

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F37,3	Home base	Home base for learners and teams that serves as the "start of the day or activity." May serve as a classroom or tutoring space.	Becomes the starting place and point for projects and a place to set group goals. Provides a common meeting place for groups of learners and teams for discussions, sharing of work, and for generation of ideas. Provides for flexible use by the learners, teams, and faculty.	*0*	*0*	10	10
	Living room	Gathering place to bring learners back together again.	Provides a shared informal learning space, access to resources, and supports socialization.				
F38,3	Caves	Individual work stations or "get away" spaces.	Provides individual spaces for work, study, reflection, and rest.	*0*	*0*	9	9
	Quiet spaces	Place for quiet reflection and to get "recharged."					

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F39,3	Collaboration space Collaboration incubator	"Office" space for groups of teams to	Provides space for teams to work together independently or collaboratively with other teams. Provides a "sense of ownership" for individuals and teams for a period of time. Provides space for complex tasks. Houses teams with different purposes and projects. Provides space for community members who are involved in the project.	*0*	*0*	7	7
F40,3	Concept "birth" space	Component of the collaboration incubator.	Supports generation of new ideas and creativity by providing access to technology, white boards/tack boards, flat surfaces, and flexible furniture.	*0*	*0*	1	1
F41,3	Bicycle parking		Provides secure and covered parking for bicycles used for projects.	*0*	*0*	1	1
F42,3	Laboratory suite	Series of different types of laboratories within close proximity of one another.	Provides adjacency and mixed use for different types of learning laboratories.	*0*	*0*	3	3

Table 4, Continued

Code	Title of the Feature	Description of the Feature	Purpose of the Feature	*Phase I # Times Listed*	*Phase II # Times Listed*	Phase III # Times Listed	Total # of Times Listed
F43,3	Coherency of learning	Courses, curriculum, and programs are congruous in content and delivery.	Layers or increments of the design create continuity in learning activities and expectations. Encourages higher engagement of learning by promoting consistency in the learning expectations and processes, and by increasing the connections to other learning activities and sites.	*0*	*0*	3	3
F44,3	Armature Fixed elements Framework	Basic framework and infrastructure for built [physical] environment. Built on human need or scale. The core elements of the building that the designers and users agree are necessary.	Creates the richness or the soul of the building and supports creative transformation of the building. Occurs through the users finishing the design for their purposes and needs. Structure built with the notion it will be adapted to new uses.	*0*	*0*	5	5

An initial analysis of all the data collected in the study was shown in Table 4. Eleven new features emerged in Phase III of the study, which were: (a) layers (F34), (b) zoning (F35) (c) classroom/laboratory (F36) (d) home base (F37) (e) caves (F38) (f) collaboration space or incubator (F39) (g) concept "birth" room (F40), (h) bicycle parking (F41), (i) laboratory suite (F42), (j) coherency (F43), and (k) armature (F44). I analyzed the 44 design features of the physical learning environment that had now been identified and described in all three phases of the study to check for any divergence in the previous clustering of features and determine the need to add new categories. Many of the new features related to learning spaces that support specific learning activities; therefore, I added the wording "Learning Spaces" to the previous category title "Learning Activities."

Learning Activities/Learning Spaces.

The features that were added to this category were classroom/laboratory (F36), home base (F37), caves (F38), collaboration space or incubator (F39), concept "birth" room (F40), and laboratory suite (F41).

Collaborative, project-based learning incorporates active learning processes such as creating or defining concepts; exploring and discovering (F41); researching information and gathering resources; building test models; practicing skills; producing information, service, or products; and presenting information to others (F39). These learning activities require different sized learning spaces, locations within proximity of one another, easy access to information and resources, and flexible furnishings that support collaboration and production of information, services, or products. Learners in these active processes also need spaces for learners to gather formally and informally (F37), among themselves and with the faculty, and quiet space for rest and reflection (F38).

Psychological/Physiological Support

Zoning (F35), bicycle parking (F41) and coherency (F43) were added to the Psychological/Physiological Support category. Zoning because it referred to providing public and private zones or areas that signaled behavioral expectations to learners and others using the space. Bicycle parking was a feature mentioned in the development of one of the designs produced in Phase III to address the need for personal transportation to easily travel to multiple sites within close proximity to conduct research and gather resources. The parking area provided convenience and secure location for personal property. Coherency referred to the design and delivery of learning in which the curricula and learning activities were linked and sequenced to give a sense of direction and purpose.

From examining the new features mentioned in Phase III, I developed a new category in which to place two features from previous phases that had not been placed into categories and to add three of the new features. The new category that arose at this point of the study was Structural Aspects that references a building's structure and infrastructure.

Structural Aspects

The features that were clustered in that category were flexible spaces (F4), adaptability (F28), layers (F34), and armature or framework (F44). This category includes those features that make up the basic framework or fixed features (F44) of the building such as the exterior structure of the building or the infrastructure such as plumbing, heating/air handling, and electrical. Modification of these features requires renovation or reconstruction (F28). Semi-fixed features allow for flexibility (F4) in the use of the space and can change easily and quickly (e.g., folding or moveable walls and flexible, moveable furniture). The feature layers (F34) refers to the level of design that initially occurs upon consensus by the designers and users and the remaining design features that are left for decision by the users.

The findings of the study, based on the literature review, data gathered using multiple methods, and through the voices of the participants have provided understanding into the two foci for the study. The identification and description of the design features addressed the first focus area of determining the design features of the physical learning environment that support and enhance collaborative, project-based learning at the community college level. The purpose statements for the features spoke to the second focus area of understanding the thinking behind or rationale for the selection of the features.

The analysis process evolved during each phase of the study. The analysis of Phase I, of which I refer to as a level one inquiry, had the intent of addressing the two foci of the study based on site visits, observations, and my notes and reflection. Phase II added the challenge of portraying the participants' voices in the translation of the data to the summary tables. Phases II and III raised the issues of retaining all the features as originally described, combining similar features, and dropping features if not mentioned further in the study. To stay within the intent of a phenomenological study, I retained all features described from all Phases in the study.

A level two inquiry occurred when I clustered features into categories. At that level, the information became more of my own interpretation based upon the context within which the features were identified and described and the rationale given as to how the features supported and enhanced collaborative, project-based learning. The clustering process was based upon common characteristics (e.g., number of people participating in a learning process; types of learning activities described by the participants such as discovery, teamwork, practice, or presentation of skills and knowledge, and the functional spaces needed to support the activities; types of furnishings that support the learning activities; elements of human needs; and the basic fixed-elements of the structure or built environment). Table 5 provides a summary of the categories.

Chapter 7 represents a further transition from the data and voice of the participants presented in Chapters 4-6 to the understandings that I gained from the study. This understanding is presented through a deeper level of analysis, resulting synthesis, and insight into future areas of research.

Table 5.

Design Feature Categories that Support and Enhance Collaborative, Project-based Learning at the Community College Level.

Group Size	**Learning Activities/ Learning Spaces**	**Adjacencies**	**Furnishings**	**Psychological/ Physiological Support**	**Structural Aspects**
F3-large, open spaces	F2-learning laboratories	F1-access to the community	F7-flexible furniture and different sizes of work surfaces	F19-personal display space	F4-flexible spaces
F11-"houses"	F6-presentation of skills and knowledge	F5-public presentation spaces	F5-tack boards, white boards	F23-sense of pride and ownership	F26-building as learning tool
F14-small group space	F12-classroom, direct instruction	F8-windows	F9-technology	F29-access to food and beverage	F28-adaptability
F15-large group space	F13-project work	F9-access to technology	F18-secured personal storage	F33-"slump" spaces	F34-layers
F21-teaching team space	F16-team work	F10-connections	F22-storage cabinets	F35-zoning	F44-armature or framework
	F17-individual work	F20-adjacent spaces	F25-durable building materials	F41-bicycle parking	
	F24-practice space	F22-storage	F30-lighting	F43-coherency	
	F26-building as a learning tool				
	F27-informal learning space				

Table 5, Continued

Group Size	**Learning Activities/ Learning Spaces**	**Adjacencies**	**Furnishings**	**Psychological/ Physiological Support**	**Structural Aspects**
	F31-shop or fabrication spaces				
	F32-technology laboratories				
	F36-classroom/ laboratory				
	F37-home base				
	F38-caves				
	F39-collaboration space				
	F40-concept birth room				
	F42-laboratory suite				

CHAPTER 7

UNDERSTANDINGS AND FUTURE RESEARCH

> Phenomenological questions are meaning questions. They ask for meaning and significance of certain phenomena. Meaning questions can be better or more deeply understood, so that, on the basis of this understanding I may be able to act more thoughtfully and more tactfully in certain situations (van Manen, 1990, p. 23).

Understandings

7

As a phenomenological study, the purpose was to seek meaning or understanding of the two foci areas of the study by interpreting the accumulated data. The study evolved over the course of two years, engaged different participants in each phase, and used different methods of collecting data in what became an iterative cycle, one step informing the next step.

The purpose of the study was to identify the design features of the physical learning environment that support and enhance collaborative, project-based learning at the community college level and to understand the thinking behind or rationale for the selection of the features. Collaborative, project-based learning was chosen as an active learning process that prepares learners to meet changing learning expectations for new roles and responsibilities of work, family, and community life in the 21st century. The following paragraphs recap the flow from changing roles and responsibilities to learning expectations and learning process.

According to Becker and Steele (1995), Coontz (1997), the National Institute of Literacy Study (2000), and the National Research Council (1999), the skills needed to meet the changing learning expectations and new roles and responsibilities of work, family, include the ability to:

- Create and pursue vision and goals,
- Gather, analyze, and use information,
- Analyze complex situations and problems,
- Identify and implement solutions,
- Use technology and other tools to accomplish goals,
- Manage resources,
- Respect and value diversity,
- Exercise rights and responsibilities,
- Anticipate and keep pace with change by directing personal and professional growth through lifelong learning,
- Develop and express sense of self,
- Provide leadership and guide and support others,
- Seek guidance and support from others,
- Think and work in terms of systemic outcomes,
- Work collaboratively in cross-functional, high-performance work teams,
- Communicate effectively,
- Take action to strengthen communities.

Collaborative learning teaches critical thinking, problem solving, teamwork, negotiating skills, reaching consensus, social and academic development, and develops a sense of community (Bruffee, 1995; Gokhale, 1995). Project-based learning is oriented to the "real" world and encourages: (a) building of relationships, (b) improving communication skills, (c) using critical thinking skills to define and solve problems, (d) using technology, and (e) promoting creativity, meaningful learning, assessment strategies, and lifelong learning (Bruner, 1990; Dewey, 1938; Eckert, Goldman, & Wenger, 1997; Kraft, 1999; Rogers, 1969; Wanket & Oreovicz, 2000).

Collaborative, project-based learning teaches many of the above skills through the active process of designing, developing, and producing products in the forms of information, service, or goods. This learning process occurs through grouping learners into various sized groups depending upon what learning activity is taking place. Direct and guided instruction is often presented to larger groups of learners by a faculty member or teaching team. Exploration and discovery can occur with or without a faculty member and can happen individually, in small groups and teams, or within larger groups. Project work more often happens in teams and includes community and business members as resource people and advisors for the projects.

The next step of the study was to seek knowledge and understanding of the design features of the physical learning environment that support and enhance the above learning activities at the community college level and to ascertain the thinking behind the selection of the features. According to Strange and Banning (2001) physical features of a campus environment can hinder or promote learning (p.31). The study resulted in 44 features being identified and described that are pertinent to supporting and enhancing collaborative, project-based learning. The study suggested that to support and enhance collaborative, project-based learning, the physical environment needed the following functional areas in which the above learning activities occurred:

- Gathering spaces,
- Planning spaces,
- Resource spaces (e.g., library, media, technology, faculty offices),
- Exploration and discovery spaces,
- Production spaces,
- Practice spaces,
- Presentation spaces,
- Community spaces,
- Direct instructional spaces,
- Informal instructional spaces,
- Quiet, reflective spaces.

This last chapter will present the understandings that I gained from the study and give the reader the opportunity to form her/his own insights from the findings and understandings I formed. As described at the end of Chapter 6, the analysis of the findings from Phases I-III was conducted at two levels. The first level of analysis examined the two foci of the study and was presented primarily from the data and participants' voices. Level two analysis became more complex during the translation of the data into the summary tables when it became necessary to occasionally add my interpretation to the description and purpose statements for clarification. At the end of Phase III, the summary table was a comprehensive listing of the different titles, descriptions, and purposes for each feature based on the data and my interpretation. To refine the analysis from the last chapter and move to a synthesis of the findings, I reviewed the design features in Table 4 to look for commonalities of function and design. As a result of the review, the number of design features was reduced from 44 to 32.

At the end of Phase III of the study, I grouped design features into the following preliminary categories: (a) group size, (b) learning activities/learning spaces, (c) adjacencies, (d) furnishings, (e) psychological and physiological support, and (f) structural aspects which was shown in Table 5. This was a rudimentary synthesis of the features. In the level two process of analysis and moving into a synthesis mode, I reviewed the features yet another time to determine if the preliminary categories were still appropriate. This last analysis indicated the label "category of learning activities/learning spaces" needed to be renamed "functional spaces for learning activities" because features describing different learning activities pointed to the necessity for specialized spaces that support the activity. Table 6 summarizes the remaining 32 design features by title, description, and purpose as they were placed into the six categories.

The analysis and synthesis processes at times were problematic when it appeared that terms chosen by the participants were similar to other titles but with slight nuances could have an impact on the learning process and the learner. An example was the feature of home base. One participant described this feature as a "living room" to bring the learners together for informal learning and socialization.

Table 6.

Design Features and Supporting Rationale of the Physical Learning Environment.

Category	**Title of the Feature**	**Description of the Feature**	**Purpose or the Feature**
Group Size	Variable sized spaces	Areas that are easily and quickly changed moment to moment, day to day, and may support several learning activities within the same space.	Provides for multiple purposes and different sized groups. Encourages and supports integration of courses and programs through sharing of space and equipment.
	Individual work spaces	Space for an individual to personalize and in which to work and study.	Provides sense of ownership and teaches responsibility for one's own learning.
	Faculty team spaces	Individual or team spaces for faculty that has adjacent material preparation areas and meeting space.	Encourages team teaching, mentoring of other faculty, integrated planning, and informal discussions.
Functional Spaces for Learning Activities	Focus laboratory spaces	Areas to support learning activities requiring specialized equipment or furnishings (e.g., science, technology, art, music, dance, fabrication, trouble-shooting).	Provides space and infrastructure to develop and practice specialized skills. Brings relevancy work, family, and community to the learning process.
	Classroom spaces	Area in which to provide direct instruction of concepts, content, and skills. Often is a space that does not require specialized equipment or infrastructure.	Supports the learning process by bringing a group of learners together to focus on specific content and for group discussion.
	Presentation spaces	Places for individuals or teams to demonstrate and perform.	Gives opportunity to practice, share acquired skills and knowledge with learners, staff, and the public, and receive feedback.

Table 6, Continued

Category	**Title of the Feature**	**Description of the Feature**	**Purpose or the Feature**
Functional Spaces for Learning Activities (cont.)	Practice spaces	Open or specialized areas with or without needed equipment to practice new skills (e.g., theatres, gymnasiums, music rooms, and dance floors).	Supports the acquisition of skills by providing space and needed tools or equipment to increase efficiency and sufficiency.
	Process galleries, studios, and display spaces	Places and furnishings to display work in progress or completed projects (e.g., white boards, tack boards, display cases, studios).	Supports and shares learning process by showcasing concept development, learning activities, development process, and finished products and services.
	Project space	Space that provides a variety of work surfaces, cabinets for supplies, storage areas for projects in the development stage, access to tools and technology, specialized lighting, and other infrastructure such as sinks and disposal.	Provides space to produce information, services, or products. Encourages critical thinking, problem solving, and teamwork.
	Home base	Gathering place for learners and faculty.	Provides a common space to start a learning activity, seek assistance and resources, share ideas, and hold group discussions.
	Informal learning spaces	Non-classroom spaces (e.g., hallways, eating areas, study spaces, lounges, and outdoor spaces).	Provides spaces for socializing, informal gathering, and serendipitous meetings that often foster creative thought and solutions to problems.
	Collaboration incubator	Idea generation space, team meeting space, access to technology and other resources, and display space for models and ideas.	Support creativity, idea generation, teamwork, and prototyping of concepts. Encourages involvement of local employers in the development of projects.

Table 6, Continued

Category	**Title of the Feature**	**Description of the Feature**	**Purpose or the Feature**
Adjacencies	Access to community	Consortia of community agencies, businesses, and learning institutions providing educational opportunities.	Creates a learning system that provides resources in the forms of curriculum, assessment, space, materials, personnel, and funding. Brings relevancy to the learning.
	Adjacent and nested spaces	Related spaces in proximity of one another.	Supports integration of learning, people, and support services.
	Visibility	Exterior windows, interior window walls, and open learning areas.	Invites participation in the learning activities by bringing processes and projects into view.
	Connections among people and spaces	Physical and visual links and movement patterns between interior and exterior spaces and among learners, family, and community. Sometimes referred to as streets or pathways.	Provides connection with others, encourages integration of activities, invites broad participation in the learning process, and movement of learning projects among functional support areas.
	Resource, supply, and storage spaces	Casements and space within or adjacent to the learning activities spaces to provide resources, store supplies for classroom projects, tools, learning products, and materials.	Provides ready access to needed supplies, tools, and storage for learning projects.
	Space and furnishings for technology	Desks, tables, and casements for technology (e.g., computers, printers, scanners, copier, telephone, facsimile, video/audio equipment, tools, text resources, research assistance).	Supports research and gathering of information, preparation and delivery of learning materials, and supports skill development in using technology.

Table 6, Continued

Category	Title of the Feature	Description of the Feature	Purpose or the Feature
Furnishings	Spaces with versatile furnishings	Moveable furniture and casements, folding walls, track lighting, multiple technologies, various sized and shaped work surfaces, and comfortable seating.	Provides flexibility in how space can be used to support a wide variety of learning activities (e.g., development of information, services, or products. Allows users to shape learning environment.
	Display spaces	White boards, black boards, tack surfaces, and show cases.	Provides places to show ideas, work-in-progress, and finished products.
	Spaces with variable lighting	All purpose, general, soft and inviting, adjustable, track lighting, task lighting, and light tables.	Provides specific type of lighting needed for different learning activities. Adjusts in intensity, focus, and location.
Psychological/ Physiological Support	Spaces that provide sense of belonging, ownership, and pride	Learning environment that evokes a sense of belonging and identity.	Encourages desire to take responsibility for the use and maintenance of the physical environment. Provokes higher interest in learning.
	Spaces with access to food and beverage	Cafes, coffee and snack carts, cafeterias, or dining rooms.	Supports different learning time frames and informal learning activities by providing something to eat and drink when it is convenient to the learner.
	"Get away" spaces	Lounge areas, small study rooms, and outdoor seating to get away from formal learning activities.	Supports need for rest, relaxation, and reflection.
	Zoned spaces	Attributes of the physical environment that encourage behavior and use of space (e.g., private or public).	Gives users and visitors cues for expected activities and services.

Table 6, Continued

Category	**Title of the Feature**	**Description of the Feature**	**Purpose or the Feature**
Psychological/ Physiological Support (continued)	Caves	Quiet spaces for individuals.	Provides quiet place for work, study, reflection, or rest.
	Natural light	Daylighting provided by exterior and interior windows.	Increases learning performance through improved psychological and physiological functioning.
	Spaces for transportation support	Bicycle parking, bus shelters, loading areas, and parking.	Supports movement of learners and projects.
Structural Aspects	Flexible spaces	Areas that easily and quickly change learning spaces moment to moment, day to day, or support several learning activities within the same space.	Provides for multiple purposes and different sized groups. Encourages and supports integration of courses and programs through the sharing of space and equipment.
	Spaces with visible infrastructure	Exposed building infrastructure (e.g., ceiling beams, plumbing, disposal, heating/air conditioning systems).	Involves the building structure as a learning tool.
	Adaptable spaces	Alteration or change in form or structure of areas to fit new use. Larger infrastructure and space changes that take more effort and time than flexible places. Concept of looking to future change and designing the structure for alteration to meet new uses.	Enables renovation of structure and infrastructure with less cost and time.
	Layered spaces	Determination of what should be built and provided for in the built environment. Areas incrementally developed as uses are identified.	Creates options and guidelines for what to build and when to build. Allows for users to define and design spaces suited to their needs and the activities occurring.

Table 6, Continued

Category	Title of the Feature	Description of the Feature	Purpose or the Feature
Structural Aspects (continued)	Spaces with durable building materials and finishes	Composition of and finishes for flooring, work surfaces, and furnishings that withstands active and frequent use.	Allows spaces to be used for planned activities with less concern about damage to and prolonging the life of space or features.
	Spaces with core or fixed-elements	Framework and basic elements of the physical learning environment (e.g., walls, floors, stairs, elevators, windows, plumbing, disposal, and electrical).	Provides basic structure and infrastructure for learning that can be "finished" by the user according the activities and needs.

Another participant specified that the home base was the starting place of the day or learning activity and was used to provide group instruction before the learners went to adjacent spaces for their individual or team purposes. Until this last analysis and synthesis, I kept these separate ideas in tact and in the final synthesis used terminology to illustrate both ideas. On the surface process galleries and project space seemed to be describing similar spaces and activities. However, the descriptions and emotions displayed or voiced when the feature process gallery was described indicated to me that there were subtle differences and I chose not to combine these two features. The portrayal given by the participant for the process gallery described a dynamic flow involving all learners and staff of the college and visitors because the gallery area was an open space that served as a connection to other areas of the structure.

When placing features into the categories, there were times I used my own judgment based upon the context of the data in which the feature was identified. As an example, daylighting, which I placed in the psychological and physiological category, resulted from use of exterior and interior windows because research shows that daylighting increases learning performance through improved psychological and physiological functioning. Windows were identified as features to provide visibility to the learning processes and to provide connections with the internal and external communities as well as providing daylighting. Windows were placed in the adjacencies category because of the increased visibility to the learning process. The feature caves was placed into the psychological/physiological category because of the space providing quiet, individual space to be used as the learner needs. The cave could also have been placed into the learning activities/learning spaces category because of the ability to do individual work in the cave. It could be argued that many of the features could be placed in more than one category.

Future Research

Through the analysis and synthesis processes, three areas emerged that appeared to warrant further exploration. The areas for future research are:

1. What are the systems of relationships among people and spaces that support and enhance collaborative, project-based learning?
2. What are the core or "fixed" elements of the design of the physical learning environment?
3. How can community colleges implement collaborative, project-based learning approaches?

What appeared to make the physical learning environment unique for collaborative, project-based learning was the need to create a system of relationships among people and learning spaces. The three designs created by the participants in Phase III visually illustrated the relationship of spaces to support the learning process. Other data from the same participants gave verbal descriptions of the relationships among the people involved in the learning activities. Reviewing the data collected in Phases I and II also indicated strong provision of systems of relationships.

Using definitions from Merriam Webster's (1993) and the Oxford English Dictionary (1989) and understanding derived from the study, the term "relationships" referred to a state of being interrelated or belonging, establishing kinship and affinity, and being mutually connected by circumstances. These relationships come to be when connections are present in the framework of the physical environment to join or unite people and learning processes.

Relationships are established through feelings of connectedness and familiarity. Building and maintaining relationships (Hendrick & Hendrick, 2000) requires skills in interpersonal communication and problem solving that results from sharing tasks, enhancing assurance, and creating social networks. Design of the built environment can enhance relationships by providing space and structural connections or hinder relationships by being spatially incongruent and disconnected. Rapoport (1982) described the physical environment as a series or system of relationships among things and people and provide structure, pattern, and visible cues for expected behaviors.

The physical environment, through the use of semi-fixed elements (e.g., signs, materials, colors, forms, sizes, furnishings, and landscapes) communicates context and desirable behaviors (Rapoport, 1982, pp. 56-57, 89). One example, as described by Strange & Banning (2001), was when a learner walked into a classroom and saw the teaching podium 20 feet in front of the first rows of desks or chairs. The learner expected the upcoming learning experience to be formal and one that did not encourage participation and involvement, or the formation of relationships (p.21). Rapaport (1982) explained that expected behaviors are expressed through

> When physical and behavioral aspects of a setting are compatible, a synomorphic relationship exists. Physical structures and designs of settings allow participants to do what they desire and allows them to take full advantage of the possibilities of the setting (Strange & Banning, 2001, p. 20).

To better understand the meaning of systems that support relationships, I turned to Capra (1996) who described two approaches, the first being the pattern of organization of the system and the second being the structure of the system. The pattern is the configuration of relationships among the system's components that determines the system's essential characteristics. The structure of a system is the physical components of the pattern of organization (pp. 158-159). Figure 6 uses the six categories of design features described in the study and illustrates a system of relationships in collaborative, project-based learning.

> Evidently, then, a large part of the structure of a building consists of patterns of relationships…the fact is the elements themselves are patterns of relationships and when the elements dissolve and leave a fabric of relationships behind, that is the stuff that actually repeats itself and gives structure to a building (Alexander, 1979, p.89).

Alexander's words reflect the findings of the study and the need for systems of relationships among people and spaces to support and enhance collaborative, project-based learning at the community college level.

The second concept to further explore is the area relating to the following features identified in the study: (a) core or fixed-elements and (b) layers. The essence of the third design created in Phase III was pushing at this concept. The participant who prepared and described the design spoke of the armature of the physical learning environment. That particular term did not resonate with my understanding of his concept. Looking at definitions of the term armature indicated a protective covering or shield. Other possible terms to describe the feature were framework, core or basic elements, or fixed-elements according to Rapaport (1982).

Another feature that was described in the study was layers, which related to the concept of core or basic elements of a design of the physical learning environment. Figure 5 illustrated the layers and framework decisions to be made while creating a physical learning environment. At the center of Figure 5 was the core of what everyone involved in the design process of a physical learning environment agreed should be built. The remaining layers indicated how the rest of

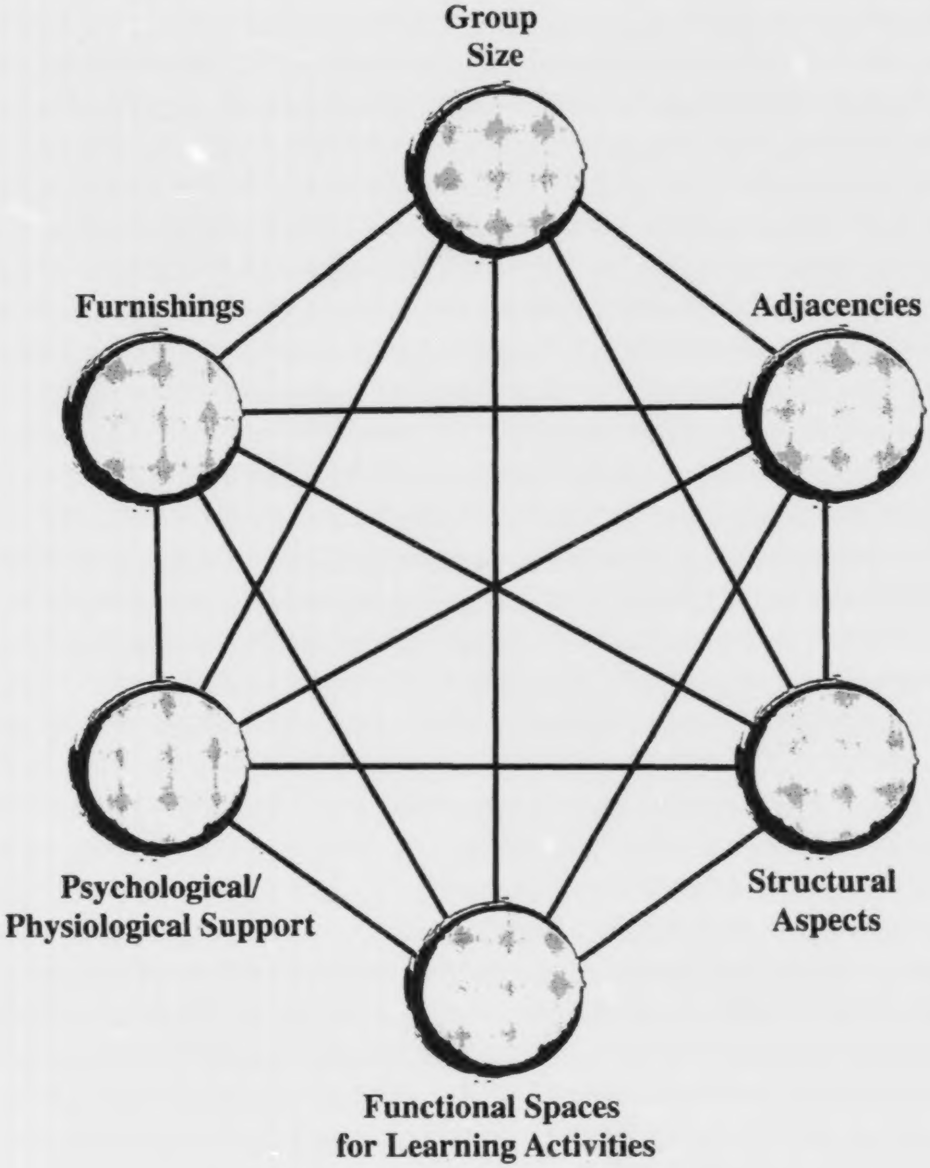
Group
Size
Furnishings
Adjacencies
Psychological/
Physiological Support
Structural
Aspects
Functional Spaces
for Learning Activities

Figure 6. System of relationships of collaborative, project-based learning.

the learning needs would be taken care of through partnerships with community agencies, businesses, and other learning providers and would not necessarily be offered at the central site. A larger remaining layer indicated the need for the users to "finish" the design or space according to their needs. Providing the opportunity to personalize the space gives a sense of identity and ownership to the learners.

The features flexibility and adaptability play a role in the determination of core elements. From my practice in working with architects and educators in designing physical learning environments, it has been difficult to look beyond the present to future uses and there seemed to be an overwhelming need to "over design" the spaces rather than allowing the users to finalize the process. Perhaps this practice of designing for the present and all the features was best described in the following two quotes:

> Almost no building adapts well. They are not designed to adapt. They are not budgeted, financed, maintained, regulated, and taxed to adapt. But all buildings adapt anyway, however poorly, because the usages in and around them change constantly. The new usages persistently retire and reshape buildings. Old churches are often torn down because the parishioners have gone and no other use can be found for the building, as lovely as it is. Old factories, because they are plain [and are designed using core elements] are revived into a collection of light industries, then into artists' studios, then offices with boutiques and restaurants on the ground floor (Brand, 1994, p. 2).
>
> We shape our buildings and afterwards our buildings shape us (quote from Winston Churchill, Brand, 1994, p. 3).

The final area of needed research that emerged from my own community college administrative experience, practice of working with architects and educators, and the data were how to implement and support collaborative, project-based learning at the community college level. When a college administrator or faculty member wants to implement collaborative, project-based learning to provide types of learning process that prepare learners for the 21st Century, they still must answer to state and federal mandates for performance and to funding sources to account for efficiencies. This decision is weighed against "time honored and worn practices and policies" focusing on numbers of learners, specific square footage allowed per learner, 50-minute time blocks, and individual silos of curriculum.

State and federal mandates identify base level learning expectations for learners and stipulate the performance standards and measures the institutions will be held to (e.g., Perkins legislation, Adult Basic Education and General Equivalency Degree, and Learning Outcomes and Assessment) and funding from these sources relates to achievement of the expectations.

According to one of the participants of the study the over-riding question is always, "what is the cost per square footage and how many FTES (full time student equivalencies) will it generate." Allocation of resources if often based on the enrollment at the institution. The State Board for Community and Technical Colleges in the State of Washington establishes service levels of FTES for each of the colleges depending upon population data in the service district. Requesting funds for renovation or capital construction is based on demonstrating a positive cost benefit ratio in terms of the numbers of students to be served in the space. Institutions with a locally controlled taxing capability must answer to the same standards to the taxpayers.

In his case study presentation at the Innovative Alternatives in Learning Environment conference, Duke described the principles for design of educational facilities from his own research. One of the principles is that the quality of the learning experience dictates the setting and not vice versa. A participant in Phase III of the study expressed frustration when "We don't abandon our failures. Once a space is designed for a particular function, we cannot turn the space into something else even though it may not be providing solutions or educational opportunities as originally envisioned."

Another participant in Phase III stated, "Once you build, you are passing on behaviors for another 60 to 70 years. Models of today are based on visions of the past and even the ideal model is based on the best of the past. We are stuck there." How then does a college move from historical practice and legislation, beyond the present, and look to 30-50 years in the future to design physical environments that remain useable and safe during the typical life span of the built environment?

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APPENDICES

Appendix A

Phase II Electronic Mail Interview
Questions

Interview Questions

Question #1:

What are the most serious/important challenges you are encountering in designing educational facilities? Why are these challenges happening?

Question #2:

Have you designed learning facilities where the emphasis was on more active learning; e.g. collaborative, project-based learning? Were these facilities for K-12 or for postsecondary levels?

Question #3:

How do you go about designing these active learning spaces?

Question #4:

What are the key features in a space designed for active learning and specifically for collaborative, project-based learning?

Additional Resources:

Please list names of other people and their contact information with whom I should be talking with and/or available resources that will assist with this research.

People:

Resources:

Appendix B

Phase II Participant Consent Form

To: AIA Conference Attendees
From: Susan J. Wolff
Date: November 17, 2000
RE: Collection of data for dissertation

As you know from our conversations at the Innovative Alternatives in Learning Environments Conference in Amsterdam, I am conducting my doctoral research on the topic of designing physical learning environments for collaborative, project-based learning at the community college level. I had hoped to schedule individual informal interviews with you during the conference, but with the demanding schedule and with all of us staying at different hotels, that format was not possible. I do appreciate your willingness to hold "email" conversations about this topic.

Before I get to the questions, I need to inform you that your identity and the identity of your firm, organization, institution, or agency will be kept confidential in the dissertation. The nomenclature used for referencing you with the data will be to assign alpha characters to each of you and if necessary, to your firm, organization, institution, or agency. Upon completion of the dissertation and the conferring of the degree, the materials gathered from you will be destroyed. Please indicate your permission for me to conduct this email interview with you by filling in the approval line below this paragraph. I also need for you to indicate if your firm, organization, institution, or agency has a non-disclosure clause, which would prohibit you from participating in this interview.

After the questions, please indicate if there are other people I should be talking with and/or resource materials that may assist with this research.

Thank you.

Susan

I am giving permission for Susan J. Wolff to use the information I give in our email interview sessions for her research in her doctoral dissertation, Window of Opportunity: Designing Physical Environments that Enhance Collaborative, Project-Based Learning at Community College. I also understand that my identity or the identity of my firm, organization, or institution will be not be revealed in this research process and the subsequent dissertation.

Name____________________________________ Date ________________

My firm, organization, or institution has a non-disclosure clause, which prohibits me from participating in this research.

Name____Date__________________

Again, thank you for participating in this research. If you have any questions or suggestions, my contact information is below:

Susan J. Wolff

Appendix C

Phases II and III Research Participants
(Names of those Participants Requesting Identification to be Released)

Siebran Baars, Senior Architect
Grunstra Architecten Groep BNA

Timothy Buckley, Architect
LSW Architects, PC
Vancouver, Washington

Frieda Campbell-Peltier, Professor
Portland, Oregon

Marilyn Johnson, Director
Science Education
Oregon Museum of Science and Industry
Portland, Oregon

Patricia J. Harlan, Student
Gig Harbor, Washington

Rita Hennessy, Professor
Portland, Oregon

Bruce Jilk, Architect and Educational Planner
KKE Architects, Inc.
Minneapolis, Minnesota

Lynette Pollari, Architect
Thompson Pollari Studio
Scottsdale, Arizona

Jim Simpson, Associate Dean of Business and Physical Education
Tomball College
North Harris Montgomery Community College
Tomball, Texas

Stephen Thompson, Architect
Thompson Pollari Studio
Scottsdale, Arizona

Ralph Willson, AIA
Principal
LSW Architects, PC
Vancouver, Washington

Appendix D

Phase III Participant Consent Form

March 10, 2001

(Participant's name and address)

Dear ,

I am conducting my doctoral research on the design of physical learning environments that enhance collaborative, project-based learning at the community college level. In addition to the design aspects, the research will also include the identification of the features of those environments. Participants will be practicing architects, community college faculty, professors, and college students who have designed, taught in, or learned in a project-based space.

The title of this research project is Window of Opportunity: Designing Physical Environments that Enhance Collaborative, Project-Based Learning at Community Colleges, Phase III. The majority of the current community college facilities were built beginning in the 1960's and were designed for 40-50 year life spans. These facilities are now in need of repair, renovation, and/or new capital construction.

The skills needed in today's places of work, in families, and in communities are better taught through active learning processes such as collaborative, project-based learning. This study will focus on the design process for the physical environment and determine the features of the environment that enhance collaborative, project-based learning.

The research will be conducted in a two-day design studio session held March 26th and 27th, 2001 at McMenamin's Kennedy School, 5736 NE 33rd, Portland, Oregon. The studio sessions will be held in the Jordan Room. I will be paying for your lodging and meals. Breakfast is included in your room charge and you will receive vouchers for other meals when you check into the hotel.

At the studio, you will be asked to participate in individual, small group, team, and large group activities to creatively design collaborative, project-based learning environments, determine the features of those environments, and to produce visual and written products that illustrate the learning environments and the features. To gain insight and understanding into the creative design process, I will be taking photographs, audio- and video recording the sessions, conducting individual audio interviews with you, and asking you to record your ideas, personal reflections, and suggestions in individual journals.

I am asking that you read the enclosed informed consent document, which identifies the following: (1) any potential risks or benefits to you as a participant; (2) a statement regarding voluntary participation and the right to withdraw; (3) a description of how your identity and contributions will be kept confidential, if you request as such; and (4) possible uses of your identity and contributions, if so requested and permission granted.

At the bottom of the informed consent form, are places for you to sign and date your agreement to be a participant and to have yourself and the materials you produce be photographed, audio- and video recorded, and your written journals collected for the use of this research. Additionally, there are appropriate places to indicate your request to have yourself and/or your firm or institution and your materials be directly attributed in this project, which may include publication or a place to request to remain anonymous. Upon completion of the project, the audio- and video-tapes will be erased.

After reading this information and agreeing to participate in this research study, please mail or fax the following consent forms and any non-disclosure clauses or policies that your agencies/firms or institutions may have. This information will be retained in the research records.

My mailing and fax information is listed below. If you have any questions, concerns, or suggestions, I have also included my phone numbers, email addresses and those of my major professor, Dr. George H. Copa. Thank you for your interest in this research project.

Susan J. Wolff

Informed Consent Document

Title of the Research Project:
Window of Opportunity: Designing Physical Environments that Enhance Collaborative, Project-Based Learning in Community Colleges, Phase III.

Investigators:
Susan J. Wolff, Doctoral Candidate
541-737-8740 (w)
541-754-0397 (h)
541-737-9044 (f)
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Dr. George H. Copa, Major Professor
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copag@orst.edu

Purpose of the Research Project:
The majority of the current community college facilities were built beginning in the 1960's and were designed for 40-50 year life spans. These facilities are now in need of repair, renovation, and/or new capital construction. The skills needed in today's places of work, in families, and in communities are better taught through active learning processes such as collaborative, project-based learning. This study will focus on the design process for the physical environment and determine the features of the environment that enhance collaborative, project-based learning.

Procedures Used in the Research Project:
I understand I will be participating in a two-day studio design workshop at which I will be asked to creatively design physical learning environments for collaborative, project-based learning, to determine the features of those environments, and to reflect on the creative design process. I understand that the activities will include individual reflection, small group, team, large group activities, report-out sessions to display materials and products, and to share insights into the process. I have read and understand the attached agenda.

Foreseeable risks or benefits/confidentiality:
I see no risks in being a participant. If I wish to remain anonymous and have my materials and thoughts kept confidential, I will be identified by an "assigned" name in the dissertation and any subsequent publications. I understand and accept that the person who will be transcribing the audio tapes will not have access to my identity and the transcription will be done under the researcher's supervision. I understand and accept that all materials produced and collected at the design studio will remain in the possession of the researcher. Upon completion of the project, I understand that the audio- and video-tapes recorded at the studio will be erased.

I understand that the benefits from this research may improve the design of physical learning environments that improve the quality of learning, thus having a positive impact on work, families, and community. I also understand that the individual participants and their firms/agencies and institutions may also benefit from being recognized in the publications.

Voluntary Participation Statement:
I affirm that my participation in this study is completely voluntary. I understand that I may either refuse to participate or withdraw from the study at any time.

Contact Information:
I have been given the names and contact information of the investigators. If I have questions regarding my rights as a research participant, I should contact the Oregon State University's Institutional Research Board at 541-737-3437.

Signatures:
My signature in the following areas below indicate that I have read and understand the procedures described above and give my informed consent to participate in this study. I understand I will be given a signed copy of this consent form. Signature on either line regarding identity permission or confidentiality includes the consent to be audio- and video- recorded and that any visual or written materials produced by me may be collected and used in this project.

Line 1:
I am granting permission for my identity and that of my firm, organization, institution, or agency to be revealed in this research and any subsequent publication of materials.

Signature of the participant	Name of the participant (please print)
Mailing address and zip code	Phone number, fax number, and email

Line 2:

I am requesting that my identity and that of my firm, organization, institution, or agency be kept anonymous. I have sent any nondisclosure clauses or policies from my agency/firm or institution to the researcher prior to the workshop.

Signature of the participant	Name of the participant (please print)
Mailing address and zip code	Phone number, fax number, and email

Appendix E

Design Studio Agenda

Window of Opportunity:
Designing Physical Environments that Enhance Collaborative, Project-based
Learning in Community Colleges, Phase III

March 26th and 27th, 2001
McMenamin's Kennedy School, Jordan Room
5736 NE 33rd, Portland, Oregon

Purpose of the Design Studio:
The purpose of this design studio is to bring together architects and educators to creatively design physical collaborative, project-based learning environments, to identify and describe the features of those environments, and to understand the thinking that entered into the design process. Collaborative, project-based learning provides a unique opportunity to learn the skills necessary to make contributions to work, family, and community in the 21st century. You will be working individually, in teams, and large groups to create the designs and to determine the features.

Definition of Terms:
Physical learning environment---encompasses actual and virtual learning spaces
Features of the learning environment---includes floor design and lay-out, relationships of and between spaces, blending of spaces, blending in the use of spaces, technology, equipment, furnishings, lighting, etc.

As a basis for this studio, the following characteristics describe project-based learning[1]:

- The context for the project is broader than the product or service being developed.
- The project involves the design and development of a product or service.
- The project extends across disciplines.
- The project extends over a significant period of time.
- The project includes several events/steps/activities.
- The participants do research using multiple sources of information.
- The project's participants work primarily as a team or small group, but individual and sub-group work also occurs.
- The resulting product/service are presented to the constituents who are to receive benefit from the product/service.
- A facilitator guides and supports the project.
- Other?

Charge to the Design Studio Participants:
As a participant in this research project, you are being asked to actively engage in designing a physical learning environment that enhances collaborative, project-based learning at the community college. Additionally, you will be asked to

identify the features of this environment and your thinking behind the features and process you see as important.

[1] Moursund, D., Bielefeldt, T., Underwood, S. (1997) Foundations for the road ahead: Project-based learning and information technologies. Eugene, OR: International Society for Technology in Education.

Design Studio Agenda:

Day 1:	
8:00 AM	Welcome Brief purpose of the studio Introductions Review of the agenda Available resources--logistics
9:00 AM	Overview of the project
9:30 AM	Reflective activity on a previous, positive project-based learning experience. This activity includes individual reflection, sharing with a small group, and posting the reflections.
9:50 AM	Break
10:00 AM	Review and discuss the postings from the previous activity. View movie clips, which are scenes illustrating collaboration and project work --- do individual reflection on the desired characteristics/skills/activities needed for project work and the environments in which project work takes place. Post and discuss this information.
10:45 AM	Teams form to design a physical learning environment(s) that enhance(s) collaborative, project-based learning at the community college level. Each team determines the use of the remainder of the day and when to break for lunch and dinner. During the design activity, each team member will be asked to individually record her/his thoughts and insights in a personal journal about the process their team is using and any major design elements and/or identified features. It is helpful to do this several times throughout the project to capture insights, creative thoughts, sketches, etc.
3:30 PM	A progress report by each team to the large group. There will be time for questions and raising of issues and concerns to the researcher during the team time as well as during this large group progress report. The researcher will be scheduling individual audio interviews for the late afternoon and early evening hours.

Day 2:

8:00 AM	Continuation of the design projects.
10:00 AM	Team presentations of their physical learning environment and the features of the environment that enhance collaborative, project-based learning.
11:00 AM	Discussion on commonalities and differences of the physical environments and the features.
12:00 Noon	Lunch
1:00 PM	Team reflection of the thinking behind/underlying the recommendations of the desired features for physical learning environments for collaborative, project-based learning and of the elements of the creative design process used by architects and educators when planning future physical learning environment. Post and discuss the teams' processes and lists
2:30 PM	Next steps and summary
3:00 PM	Adjournment

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